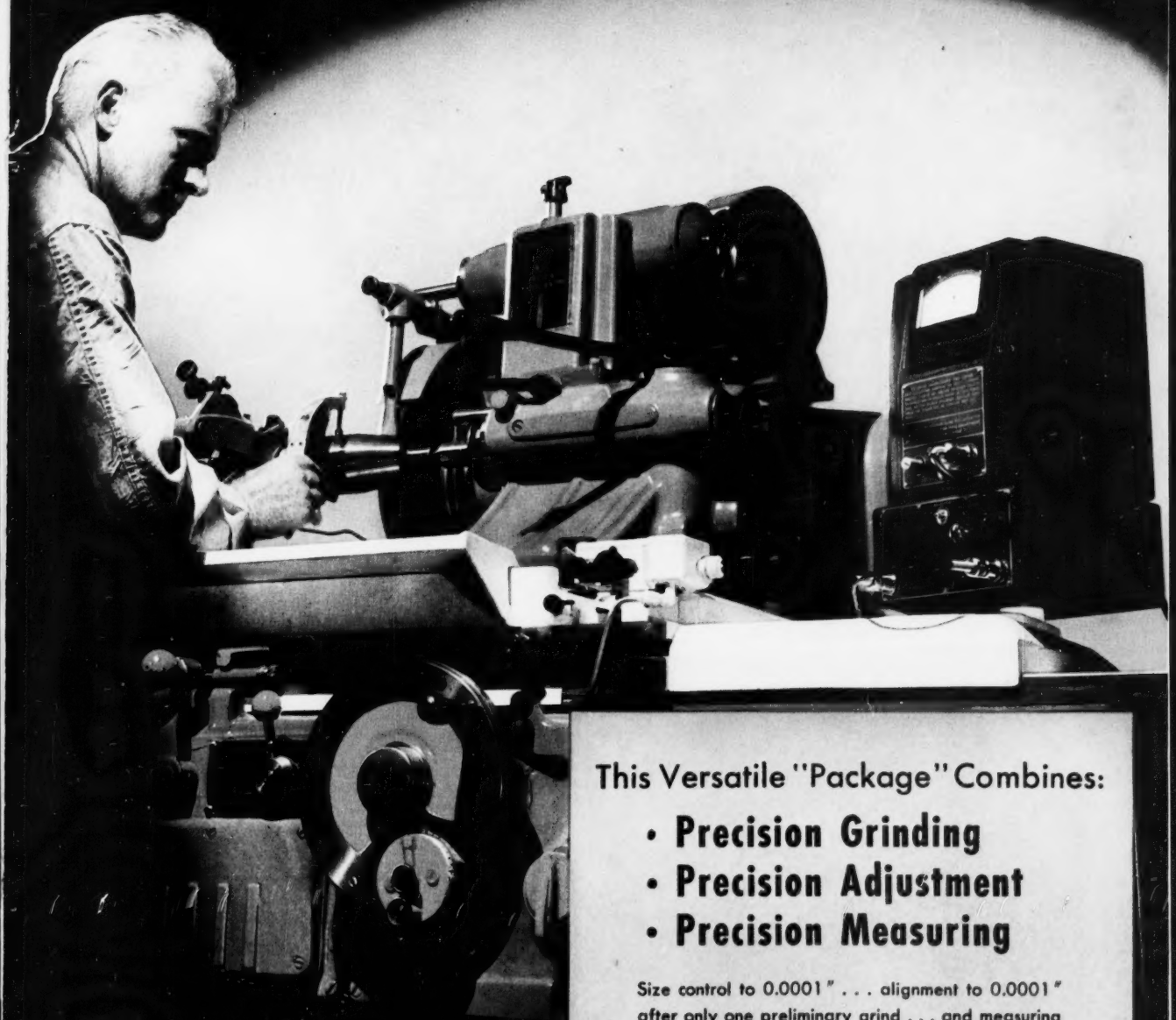
MAY 1954—SIXTIETH YEAR

MACHINERY



This Versatile "Package" Combines:

- **Precision Grinding**
- **Precision Adjustment**
- **Precision Measuring**

Size control to 0.0001" . . . alignment to 0.0001" after only one preliminary grind . . . and measuring to 0.00001"! That's the precision "package" you get when you specify an ELECTRALIGN-equipped Brown & Sharpe Grinding Machine . . . a new No. 1, 2, 3 or 4 Universal, a No. 5 Plain, or a No. 13 Universal and Tool.

Read full details on pages 237 and 238.

Brown & Sharpe

B·S

Look, Daddy—a steam engine!

THAT's right. Kind of a rare sight these days. Looks like the good old "iron horse" is headed for the last round-up.

Why? Competition mostly. Something *better* came along. Locomotives that were more efficient—less costly to operate and maintain. That's the way it goes. Competition means progress for some things, obsolescence for others.

Naturally you want *your product* to be a success in the competitive days ahead. So you're probably looking right now for new ways to improve quality and cut production costs. That's where we here at Heald may be able to help. New Heald developments in automation, battery-type equipment, way-type and transfer-type Bore-Matics, plus a number of advanced design features, can now be applied to a wide variety of jobs. We'd like to show you what a fresh Heald viewpoint and latest Heald equipment can do—on long or short runs, single or multi-purpose setups.

Competition is wonderful when you're *ahead* of it. Our business is to keep you there. That's why IT PAYS TO COME TO HEALD.

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MACHINERY

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The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

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Now...

A LANDIS THREAD

LANDIS
Machine
COMPANY
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3M-D

LANDIS

ROLLING MACHINE

. . . the LAN-HY-ROL, generating external threads by the chipless cold-forming process, offers important improvements in production economy and thread finish. This machine is being built under an exclusive license agreement with Pee-Wee Maschinen und Apparatebau of Berlin, Germany, manufacturers of the world-famed Pee-Wee Thread Roller.

The new LAN-HY-ROL offers the same outstanding combination of precision, productivity, and flexibility which has made the German Pee-Wee Thread Roller unequalled in its field. We will share engineering knowledge and experience with Pee-Wee, and jointly conduct an extensive program of research and development. Significant improvements will be incorporated in the LAN-HY-ROL, comparable to those which have made other LANDIS Equipment outstanding in Thread Cutting, Thread Grinding, and Thread Tapping.

The new LAN-HY-ROL is another forward step in more than 50 years of LANDIS history, during which we have been continuously offering more efficient methods of generating screw threads.

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CUTTING - TAPPING - GRINDING - ROLLING

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THE Fellows

OF SPRING...

The winter's production of small gasoline engines with all their Fellows-cut cams and gears... starting up with the lush green grass

Photo Courtesy Pioneer-Gen-E-Motors

Typical Fellows gear cutting performance is shown here on a power-mower crank shaft.

The marvel is not only their number in total thousands, but the quality that's built into them for the price the engine maker gets.

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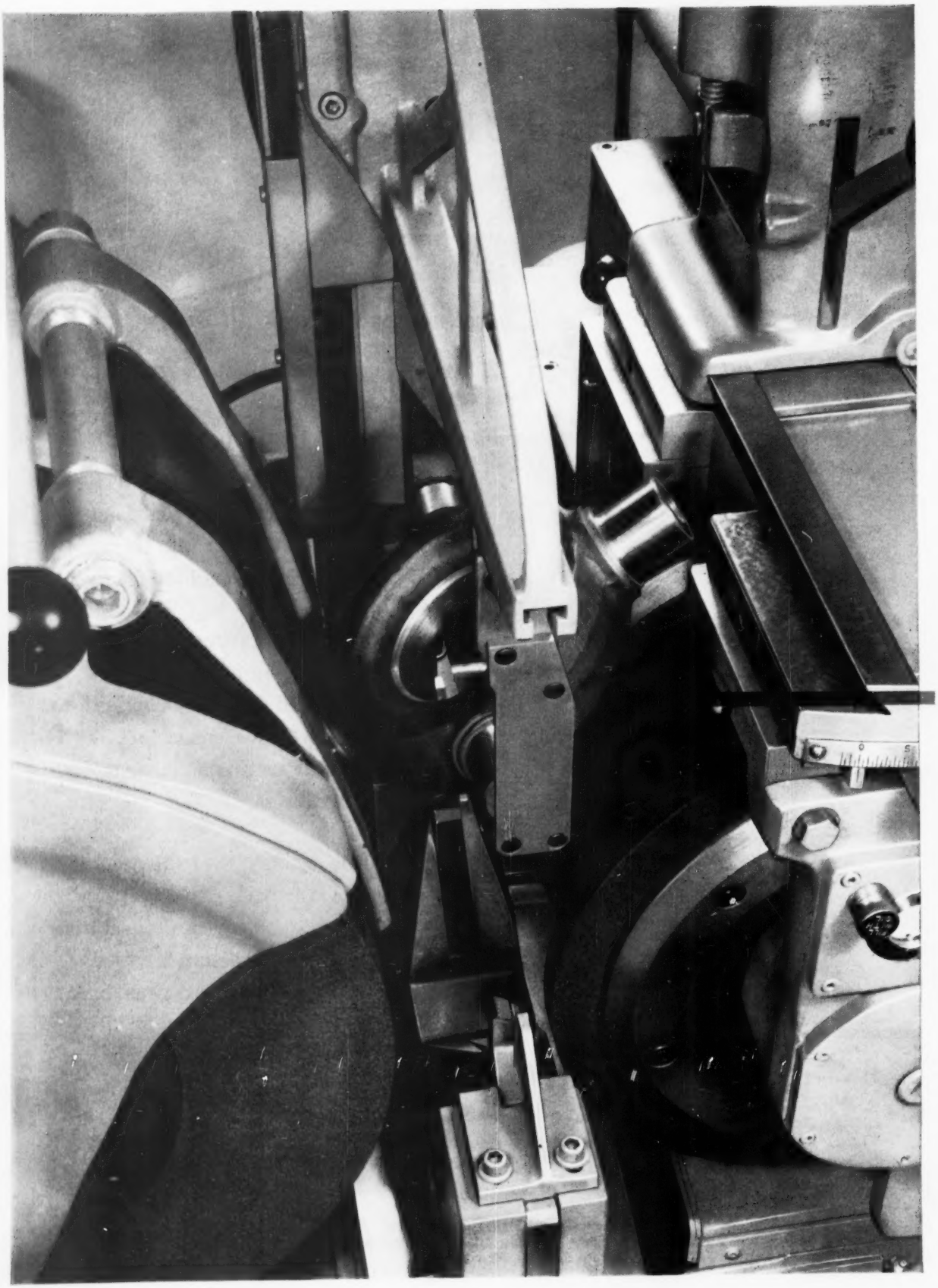


CINCINNATI FILMATIC No. 3 CENTERLESS
Grinds Two Diameters Requiring 7X Swing

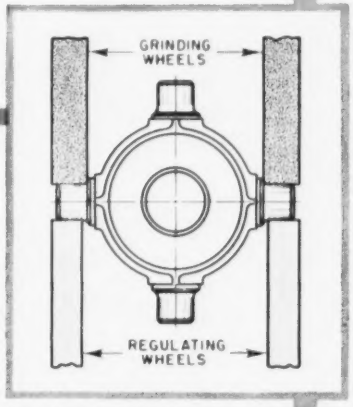
New applications for CINCINNATI Centerless Grinders are always popping up. The latest is illustrated here . . . a two-wheel setup to grind simultaneously two trunnion diameters on universal joint spiders. Swing required for the center section is approximately 7 times the ground diameters. ¶Cincinnati Application Engineers tooled up a CINCINNATI FILMATIC No. 3 Centerless Grinding Machine for the job. Equipment includes profile hydraulic truing units over the grinding and regulating wheels; special grinding wheel guard and regulating wheel housing to permit loading; automatic infeed attachment; hydraulically operated loading fixture; manually operated grinding wheel spindle reciprocating attachment. With the latter attachment, the operator touches up the shoulder and radius adjacent to the ground diameters. ¶You probably have precision grinding operations in your shop that could be centerless ground on a CINCINNATI at lower cost. It will pay you to reconsider your present methods, and our Application Engineers will help you decide. Meanwhile, you may obtain the CINCINNATI Centerless literature of your choice by writing to the address below. Illustrations and brief specifications in Sweet's Machine Tool Catalog.

CINCINNATI GRINDERS INCORPORATED

(Subsidiary of The Cincinnati Milling Machine Co.)

CINCINNATI 9, OHIO

CINCINNATI FILMATIC No. 3 Centerless Grinding Machine. You may obtain complete specifications by writing for catalog No. G-570-3.



Drawing of part and arrangement of wheels. Two diameters are ground simultaneously, removing .015", .008", and .003" in three operations, on a CINCINNATI FILMATIC No. 3 Centerless Grinding Machine tooled up by Cincinnati Application Engineers.

Cincinnati Offers the Only Complete Line of Centerless Grinding Machines

No. 0
Catalog No. G-576-2

No. 2
Catalog No. G-611-1

No. 3
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No. 4
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No. 5
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No. 6
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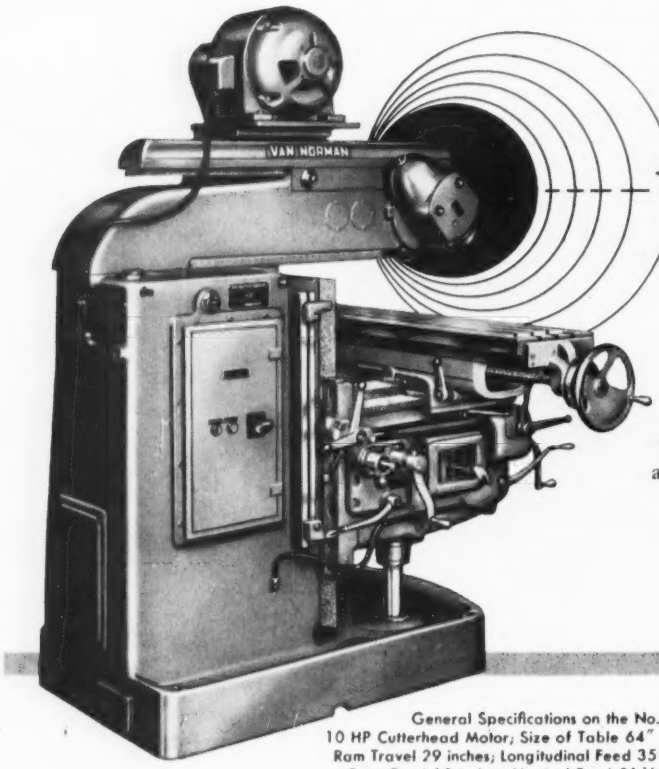
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

For more information on products advertised, use Inquiry Card, page 247

all 10 of Van Norman's new Ram-Type Millers have this exclusive feature

VAN NORMAN 38-M RAM-TYPE MILLER



General Specifications on the No. 38-M:
10 HP Cutterhead Motor; Size of Table 64" x 14";
Ram Travel 29 inches; Longitudinal Feed 35 inches;
Cross Feed 12 inches; Vertical Feed 21 ¼ inches.

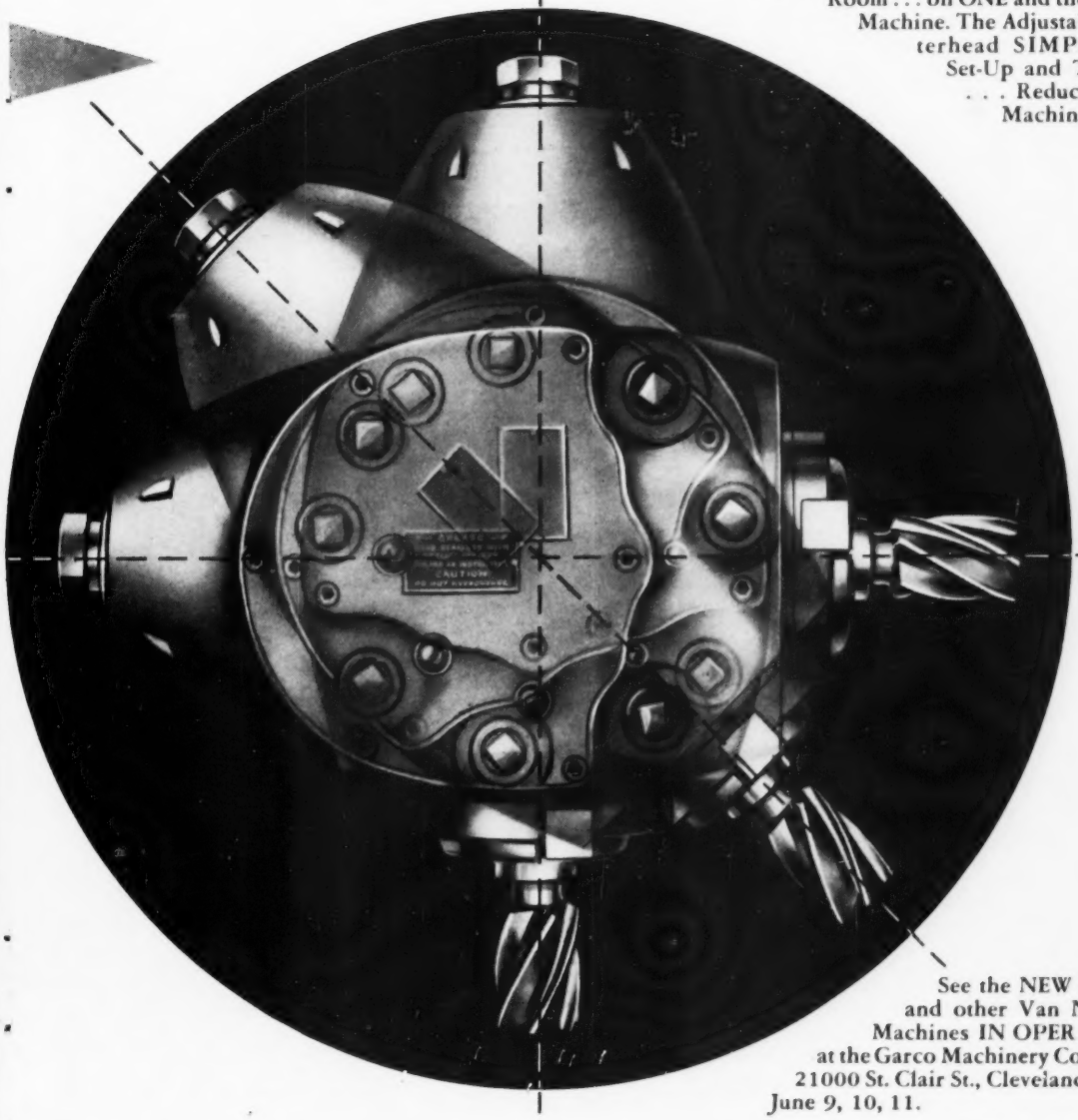
Check the exclusive features of Van Norman's new Ram-Type Millers . . . like the No. 38-M shown at the left. Every one of these machines has:

1. Maximum "FLEX-ABILITY" . . . because of the quickly adjustable cutterhead mounted on the Heavy Duty sliding ram.
2. Maximum "CUT-ABILITY" is provided through NEW Heavy Duty gears with up to 10 Horse Power Motors. Plenty of Power and Stamina to meet any milling requirement . . . tool room or production . . . it makes no difference to the NEW Van Norman Ram-Type Millers.

VAN NORMAN manufactures Ram and Column Type Milling Machines . . . Cylindrical Grinders . . . Centerless Grinders . . . Spline and Gear Grinders . . . Oscillating Radius Grinders . . . Special Production Grinders.

WITH THE ADJUSTABLE CUTTERHEAD

You do Horizontal, Vertical, OR Angular Milling . . . Production or Tool Room . . . on ONE and the SAME Machine. The Adjustable Cutterhead SIMPLIFIES Set-Up and Tooling . . . Reduces Idle Machine Time.



See the NEW Millers and other Van Norman Machines IN OPERATION at the Garco Machinery Co. Show, 21000 St. Clair St., Cleveland, Ohio, June 9, 10, 11.

See Your Dealer or Phone, Wire or Write

VAN NORMAN COMPANY
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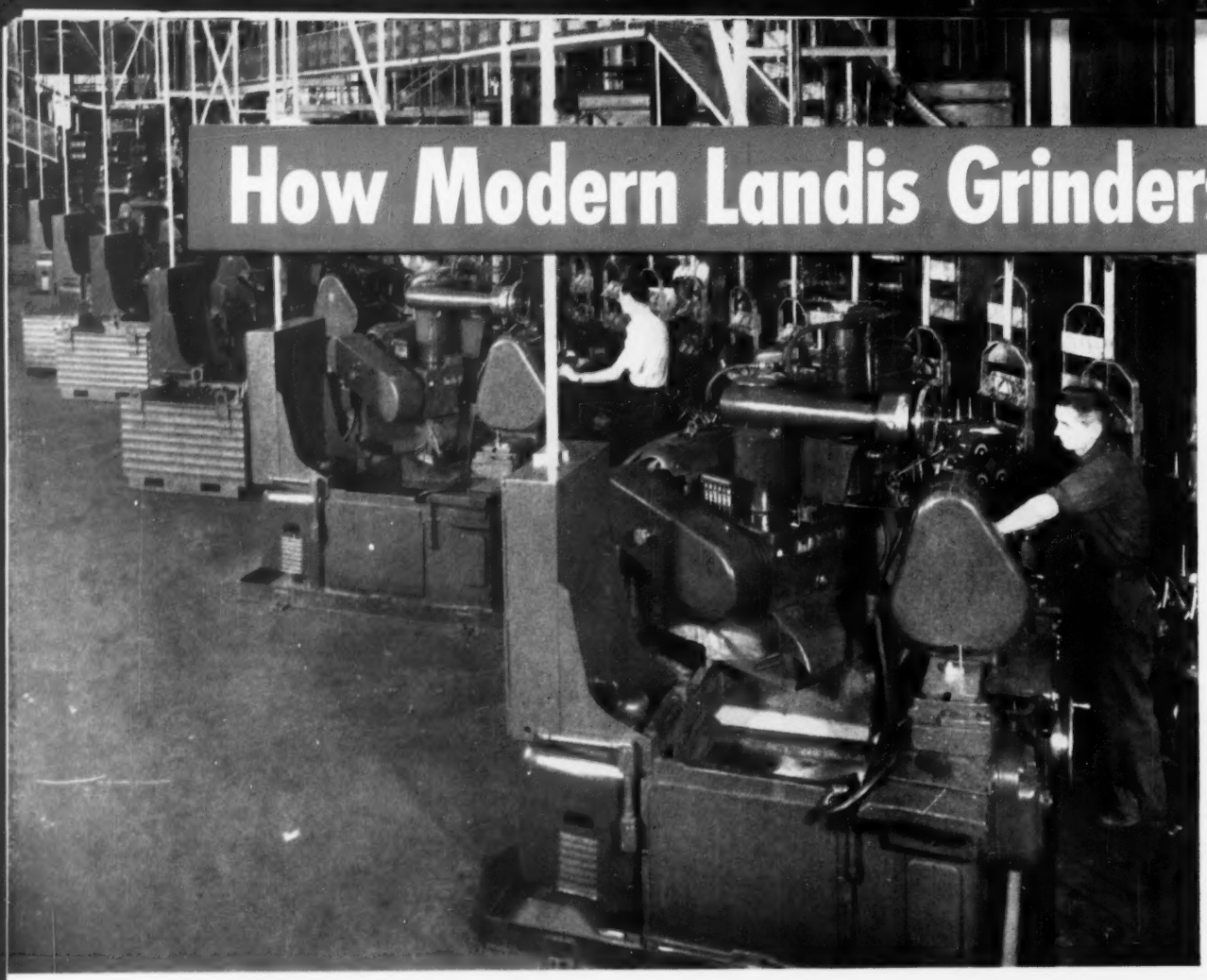
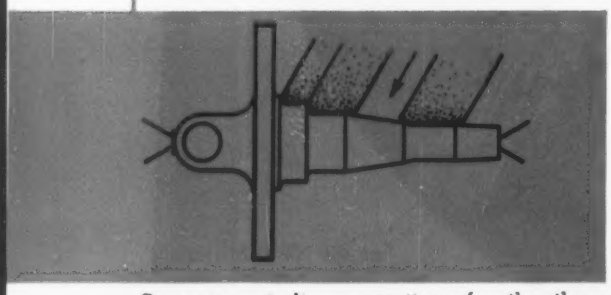
How Modern Landis Grinders



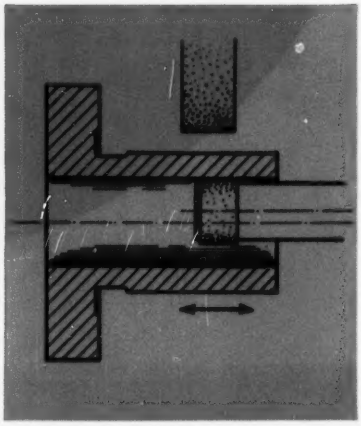
Machine output increased 4 times



Separate grinding operations for the three diameters and three blending radii of front wheel spindles are now combined into one on modern Landis Plain Grinders.

171

Flexible operation cuts setup time—output up 37%



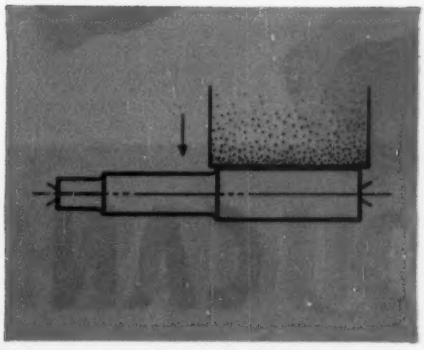
Modern operating features of Landis Universal grinders make these savings possible by reducing scrap loss and cutting setup time.

LANDIS

precision grinders

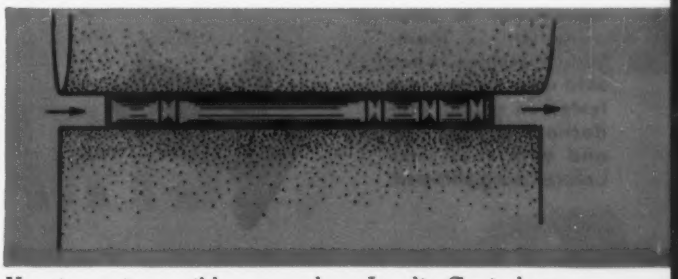
Cut Costs and Increase Output

25% over-all savings by replacing obsolete plain grinder



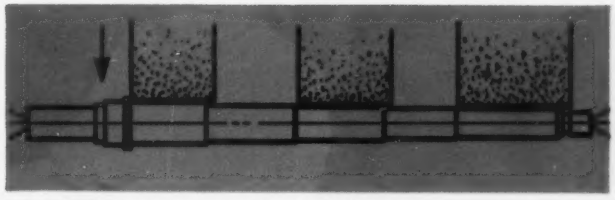
The modern high production features of Landis plain grinders jumped production of these tap blanks from 280 to 400 per day. Semi-automatic cycle includes hydraulic infeed and timer.

Gives double production with half the machines



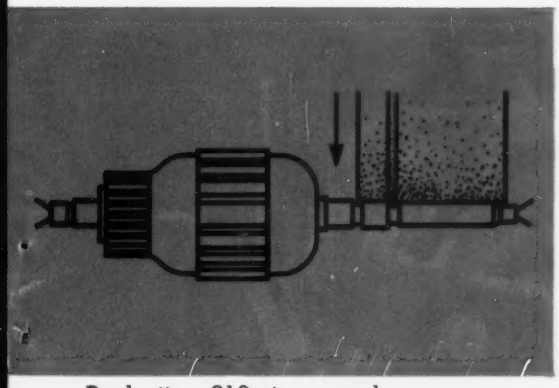
Heavier cuts possible on modern Landis Centerless Grinders enable an automotive plant to grind gear-shift rails at a faster rate. Jump in output is from 2300 to 4800 pieces per day with only two machines instead of four.

Eliminate extra grinding operations



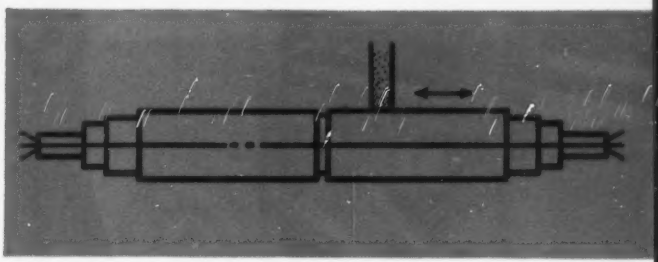
Grinds 3 diameters and a shoulder in one operation on a modern Landis Type IW Multiple Wheel Grinder. Concentricity assured by grinding all diameters at one setup.

Modern operating features increase output 40%



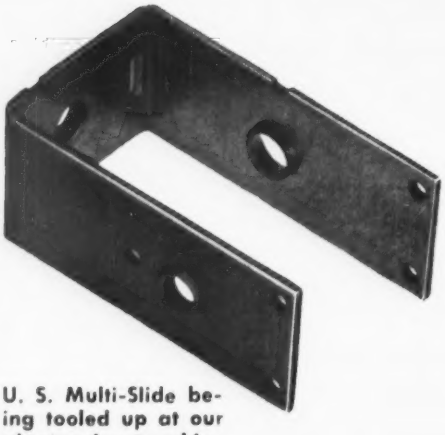
Production: 210 pieces per hour
Hydraulic feeds and timed grinding cycle of modern Landis 4" Plain Grinder increased output of armature shafts. Replaced hand operated machines.

Grinding time reduced 30% on large modern grinder



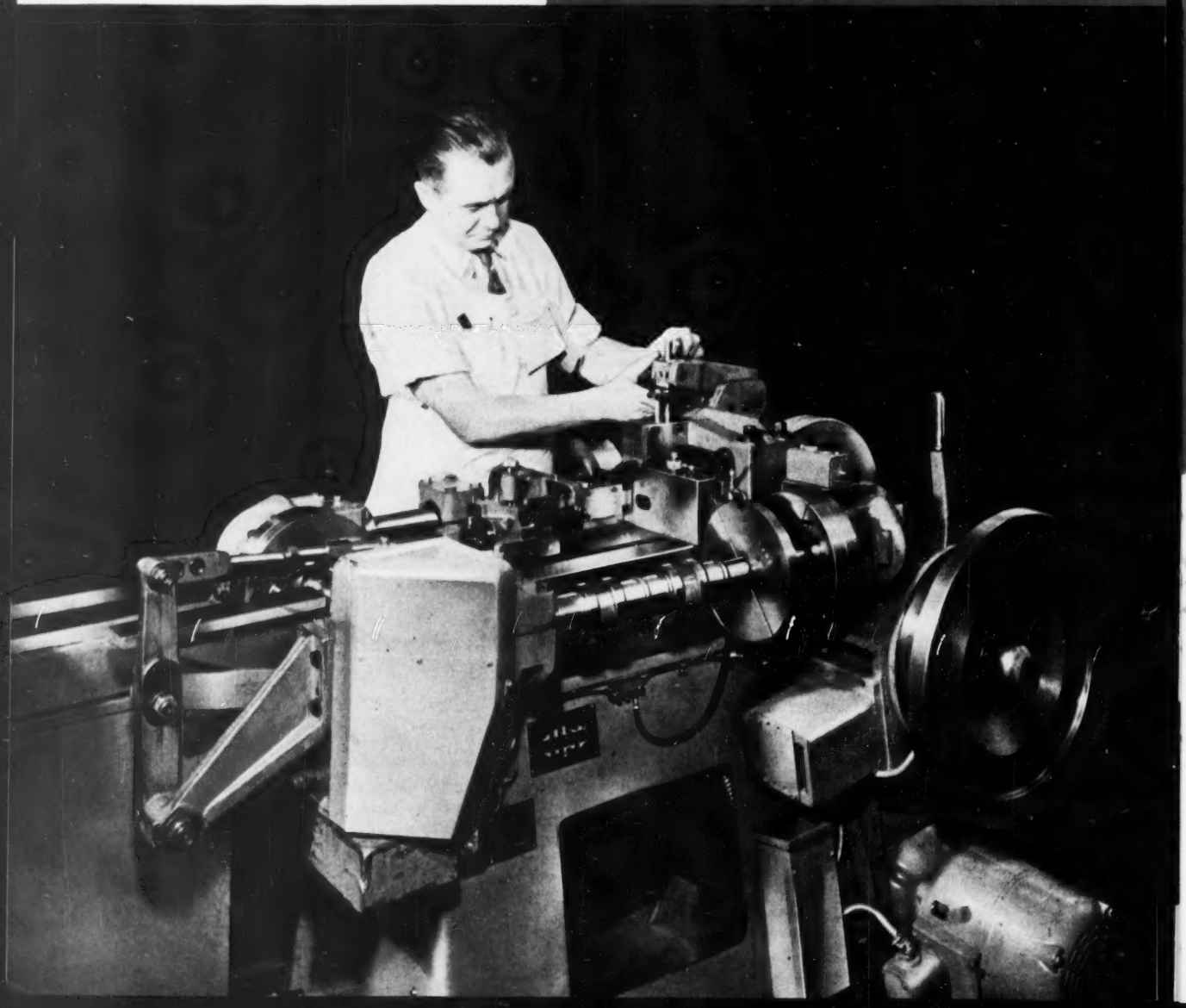
Modern Landis Grinder permits heavier cuts on printing press cylinders; eliminates extra passes once required.

LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U.S.A.

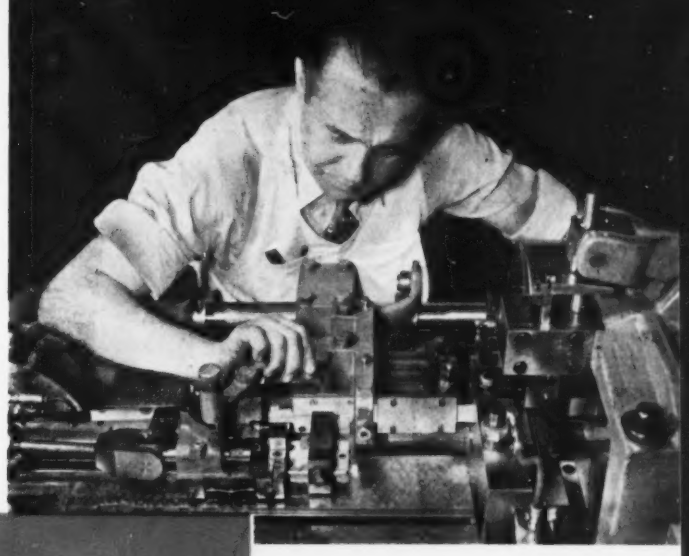


U. S. Multi-Slide being tooled up at our plant prior to shipment. U. S. Multi-Slide Machines, when sold with tooling, are tested in actual production on your part and with your stock before being shipped.

YOU CAN



Top of the bed of a No. 28 U. S. Multi-Slide Machine, with the operator making adjustments to the stock guides. Forming slides and vertical stripper movement, standard equipment on the machine, are shown at right in the photo.



PRODUCE PARTS LIKE THESE ON THE U. S. MULTI-SLIDE®

All the parts shown above and on the facing page were tooled for production in U. S. Multi-Slide® Machines by the General Tool and Engineering Company, Dayton, Ohio. They illustrate just a few of the many different types of parts which can be produced complete in the U. S. Multi-Slide — without secondary handlings and at profitable high production rates.

The feed unit, ram, forming slides and vertical stripper (which are included as standard equipment) make it possible to produce complete parts of complicated nature to close tolerances at each stroke of the machine. The U. S. Multi-Slide may be tooled up to perform trimming, piercing, shearing, embossing, swaging and forming operations in a great variety of combinations.

You, too, can reduce labor costs, increase production and improve quality by using U. S. Multi-Slides for the production of your precision formed stampings.

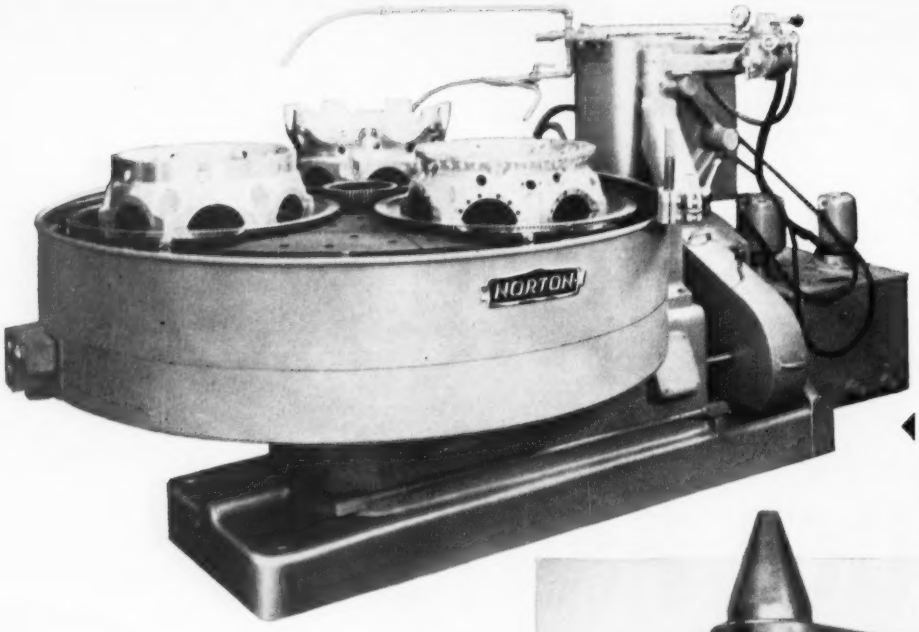
Bulletin 15-M contains complete specifications for all four sizes of U. S. Multi-Slide Machines. Ask for a copy.

U.S. TOOL COMPANY, Inc.

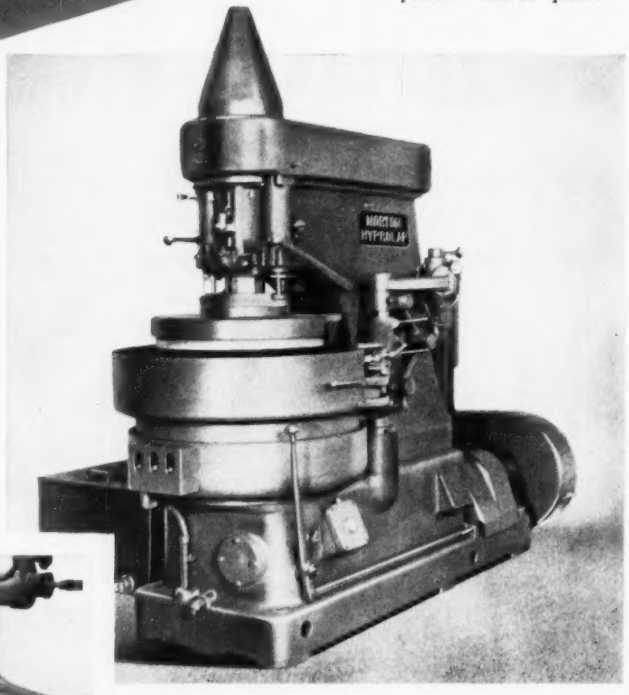
AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides — U. S. Multi-Millers

U. S. Automatic Press Room Equipment — U. S. Die Sets and Accessories

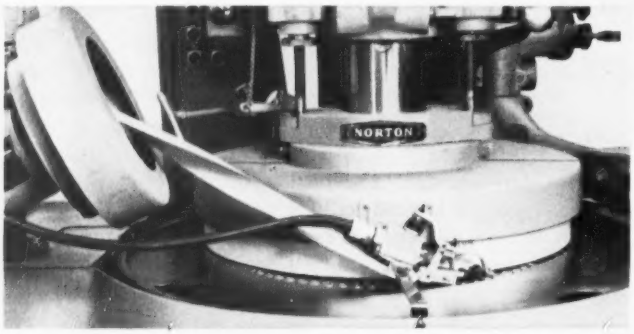


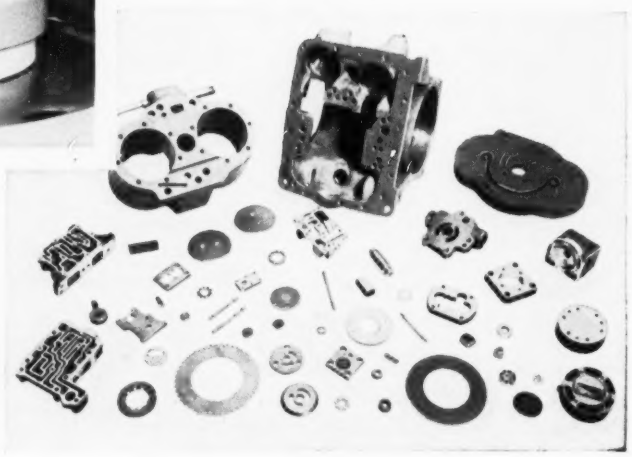
60" single face flat lapping machine. Bonded abrasive laps make it a sensational performer, particularly on soft metals. It produces a clean finished surface free from imbedded grit. Provides seal surfaces, wear surfaces or flat surfaces for other machining operations. Hydraulic pressure device is available for light work; power-operated truing arm, loadless starting inertia-delay clutch. Capacity range, three 24" pieces — one 60" piece.



Hyprolap lapper No. 26. Extremely fast-cutting machine using bonded abrasive laps and filtered coolant. Finishes 20 or more work pieces simultaneously with a combination of accuracy and finish-uniformity otherwise unobtainable in mass production. Easy to operate. Lapping pressure is hydraulic powered and controlled — an exclusive Norton feature. Work capacity up to 3" thickness or diameter, to 7½" length.

Through-feed No. 26 Hyprolap machine. 4-to-1 savings proved on finishing small, flat parts. Handles small pieces up to 8,000 an hour. Loading and unloading are entirely automatic . . . less downtime for lap dressing because work path traverses the entire work surface of each lap. High worker skills are not needed. Work up to 1¼" diameter. Modifications to handle larger work.





NORTON JOB LAPPING SERVICE

Improve your product quality by precision lapping. The new enlarged Norton Job Lapping Department is ready to finish parts to your exact specifications. Complete and modern in every detail, the new department is manned by personnel skilled in every type of lapping process. Jobs handled include flatwork up to 24" across and cylindrical work from 1/16" diameter by ½" long to 2" diameter by 8" long, in practically every material. The best type of lapping for your requirements — with rapid stock removal and highest precision finishes — can be produced. See your Norton Representative for details, or write us direct.

5 great machines... 1 big objective...

to cut your lapping costs

Here they are. Five outstanding lapping machines by Norton. Designed for single or multi-purpose — but all built to give you fastest, cleanest lapping performance at lowest possible operating cost.

Every second of operation, value is being added to the product through a finer, smoother, precise finish achieved in less time. This adds to your profit margin and to the ultimate user's satisfaction.

Whatever your needs there is the right Norton Lapping Machine to give you maximum output, minimum down-time; higher quality work and less dependence on manual skills.

Send for more complete information or submit samples of your work for correct lapping machine application and production. NORTON COMPANY, Machine Division, Worcester 6, Mass.

To Economize, Modernize With NEW

NORTON

GRINDERS and LAPPERS

Making better products . . . to make other products better

District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit
In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5

Vertical lapping machine type 16FC has outstanding production capacity in such work as diesel injector parts, plug gages, size blocks, the sides of rings, and rollers. It produces flat or cylindrical work to a high degree of dimensional accuracy, parallelism and finish. Work capacity: 3″ x 5″ flat and 3″ diameter cylindrical.

Simplex surface finisher No. 12. A highly efficient machine which uses flexible coated abrasives. Ideal for handling small crankshafts for refrigerator compressors and outboard motors, eccentric and concentric cylindrical surfaces, journals and seal surfaces on many cylindrical parts. Work capacity: ½″ to 2½″ diameter; up to 12″ length.

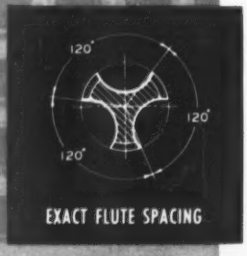
For more information on products advertised, use Inquiry Card, page 247

It pays you to use

BALANCED *Action* TAPS

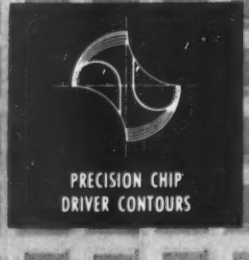
It takes care and skill to make taps that perform with BALANCED ACTION. Only Winter makes them.

It pays you to use BALANCED ACTION taps because of their accuracy—their longer life—and your saving in scrap losses.



EXACT FLUTE SPACING

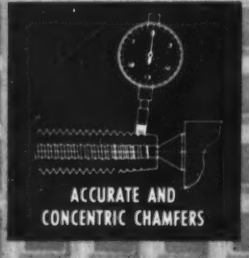
UNIFORM FLUTE CONTOURS



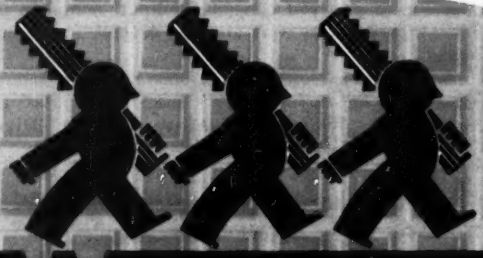
PRECISION CHIP DRIVER CONTOURS

ALWAYS AT YOUR SERVICE

Your local Industrial Supply Distributor carries a complete stock of WINTER Balanced Action Taps.



ACCURATE AND CONCENTRIC CHAMFERS



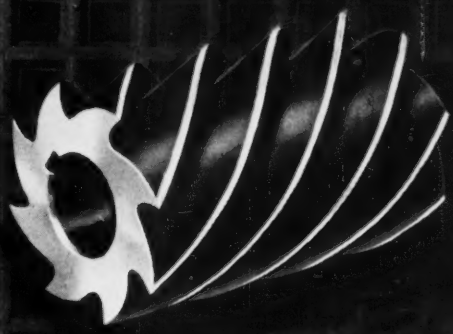
WINTER

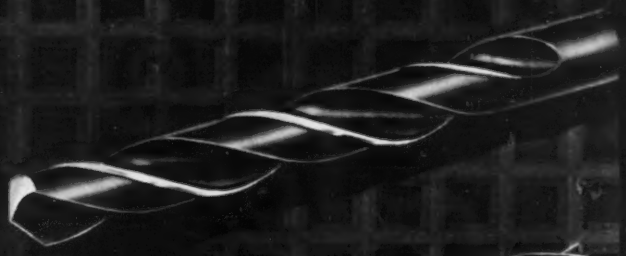
WINTER BROTHERS COMPANY

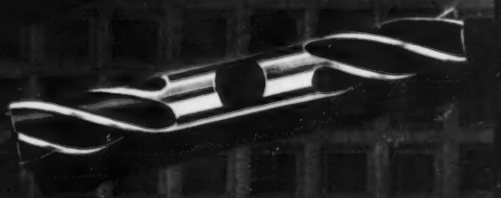
Rochester, Michigan, U.S.A. Distributors in principal cities.

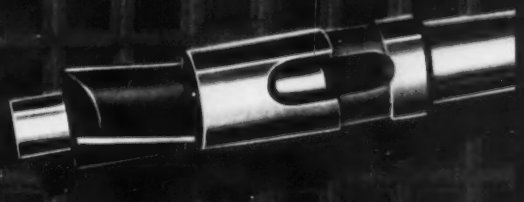
Branches in New York • Detroit • Chicago • Dallas • San Francisco

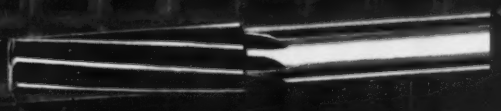
Division of National Twist Drill & Tool Co.

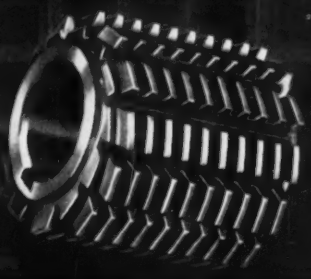












Cutting Edges That *Cut Costs*

Once you start using National Tools—whether for roughing or finishing, for production or for accuracy—*you'll stay with them.* Their fine cutting edges give you the better work that cuts your costs.

NATIONAL TWIST DRILL AND TOOL COMPANY

Rochester, Michigan, U.S.A.

Distributors in principal cities.
Factory branches: New York • Detroit
Chicago • Dallas • San Francisco

CALL YOUR INDUSTRIAL SUPPLY DISTRIBUTOR for all your staple industrial needs, including NATIONAL Twist Drills, Reamers, Counterbores, Milling Cutters, End Mills, Hobs and Special Tools.

NATIONAL TWIST DRILL & TOOL ROCHESTER, MICH., U.S.A.

National

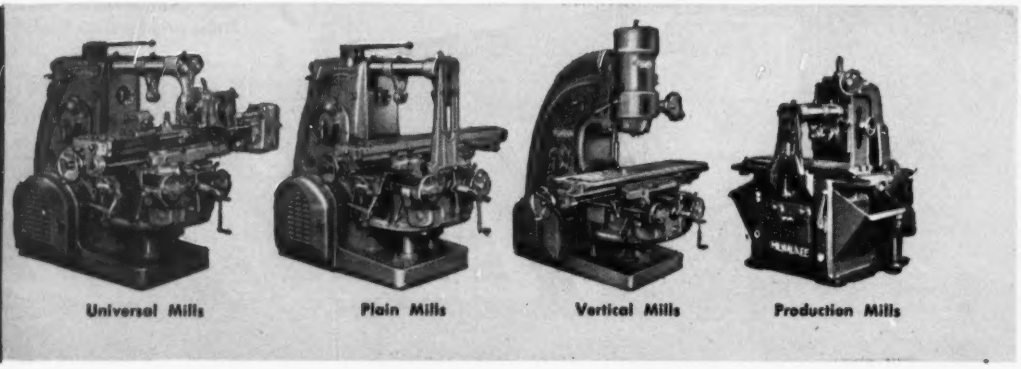
Don't wait....

Investigate

KEARNEY & TRECKER'S TOOL-LEASE PROGRAM

...the common sense approach to your plant modernization problem

Here are a few of the many new Kearney & Trecker machines available for Tool-Leasing



Universal Mills | Plain Mills | Vertical Mills | Production Mills

Here's the most significant opportunity ever offered machine tools users

In these times, modernization is the soundest approach to meeting increasingly competitive conditions. And the best way to modernize — to improve products, cut costs, gain productive flexibility — is to retool with new machines. Today, Kearney & Trecker's new Tool-Lease Program offers you an unmatched opportunity to "junk the clunkers" that are nibbling away at your profits. It's time to act. Don't wait — investigate!

These are only a few of the advantages Tool-Lease offers you

In the first place, you can try out new machines in your own plant . . . without being obligated to purchase them. Secondly, you can get hitherto impossible flexibility and capacity to take advantage of changing production requirements without the risk of obsolescence. Last, but not least, you can expand production without tying up working capital, going into debt, or impairing future borrowing capacity.

Tool-Lease helps you get the exact milling or boring machines you need

Under Tool-Lease, you can rent any Kearney & Trecker standard knee or bed type milling machine or precision boring machines. If you require special machinery or heavy-duty CSM bed-types, special agreements will be considered.

Three basic plans give you varying options to continue or terminate the lease or purchase the equipment.

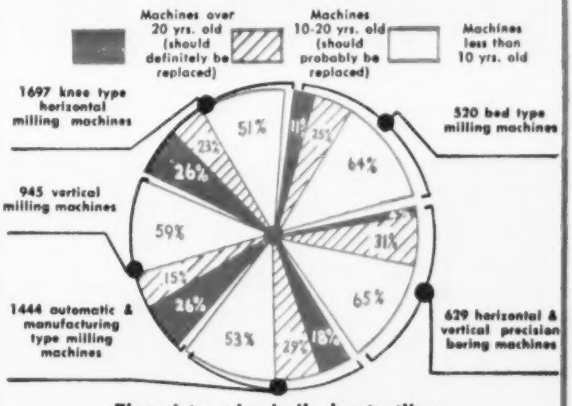
For complete details on Tool-Lease . . . help in analyzing your milling and precision boring needs — see your Kearney & Trecker representative or mail coupon to Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.

TOOL LEASE
KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS
EQUIPMENT ®

©1954

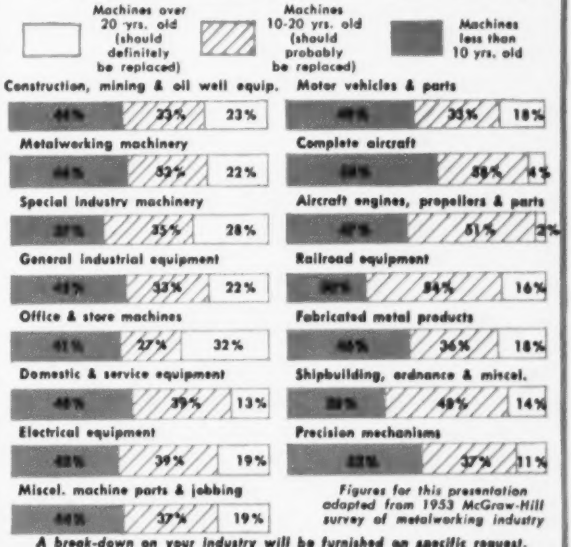
THE CRITICAL PICTURE OF CREEPING OBSOLESCENCE . . . AND HOW TO STOP IT!

Let's take a typical basic industry as an example — Agricultural equipment. Of the 5199 standard knee type horizontal, vertical, bed and manufacturing milling machines and precision boring machines in use today — *which could be replaced by Tool-Lease equipment*—26% are 10-20 years old, 19.9% are more than 20 years old.



The picture is similarly startling in 15 additional basic industries

The Agricultural Equip. and 15 other industries listed are using 150,825 standard knee-type horizontal, vertical, bed and manufacturing milling machines and precision boring machines. 18% are over 20 years old, 38% are 10-20 years old. How do you stand in your industry?

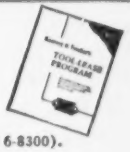


Figures for this presentation adapted from 1953 McGraw-Hill survey of metalworking industry

A break-down on your industry will be furnished on specific request.

Rotary Head Milling Machines **Autometric Precision Boring Machines**

Kearney & Trecker Corporation
6784 W. National Ave.
Milwaukee 14, Wis.



Please send me Bulletin TL-10A with details on the Tool-Lease Program.
☐ Check here if you would like to have a representative call on you as soon as possible (or call Milwaukee, GReenfield 6-8300).

Name.....

Title.....

Company.....

Address.....

City..... Zone..... State.....

Flame-hardened and ways are standard

• Here, a skilled G&L craftsman, using G&L developed equipment, flame-hardens ways for a 30 Series machine. The greater hardness helps maintain the higher, longer-lived machining accuracy you get with G&L machines.

precision-ground on the G&L 30 Series

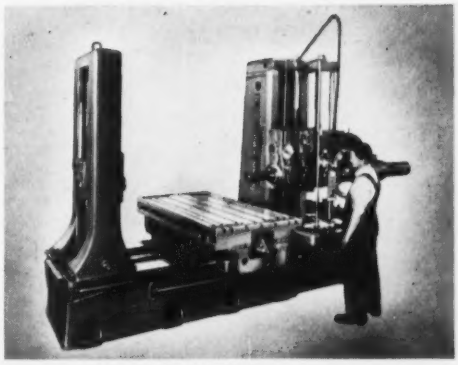
Hardened and ground bed and saddle ways are only one of the many plus features that are standard equipment on the G & L 30 Series table type Horizontals

IF you're searching for a horizontal boring, drilling and milling machine to handle large or small work, simple or complex set-ups, long or short runs — it will pay you to find out about the G&L 30 Series.

You'll discover that 30 Series machines allow you to perform boring, drilling and milling with equally high efficiency. You'll see, too, that no other machine on the market today offers you so many distinct performance and capacity boosting features as standard equipment.

Here are only a few of them — 45 all-geared spindle speeds in fine increments, 36 feeds, positive gear drive for heavier cuts, rapid change of feeds and speeds with full horsepower in the higher speed ranges.

Your investigation will convince you that a 30 Series machine is in a class by itself — often copied, never equaled. For complete details, see your G&L representative or write for the new 30 Series catalog.



There are two basic models in the 30 Series — the 340-T with 4" spindle and 20 hp, the 350-T with 5" spindle and 25 hp. Both machines offer a choice of three basic arrangements of table and saddle.

Hardened ways for bed and saddle are micro-finish ground, feature exceptionally accurate alignment.

GIDDINGS & LEWIS MACHINE TOOL CO.

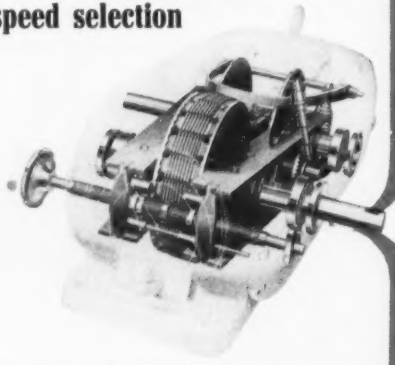
FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty machine tools — Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers; Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools

WHY ALL industry uses P.I.V.

LINK-BELT's P.I.V. provides positive, infinitely variable speed selection

ALWAYS POSITIVE



ALWAYS STEPLESS

WHEREVER speeds must be varied—instantly, exactly, positively—you'll find Link-Belt's P.I.V. at work. Here's a variable speed drive that operates independent of friction. Exclusive self-tooth-forming chain meshes with grooved wheels, transmits power with no wasteful slip.

Without stopping the machine, you can select the speed you need—from maximum to minimum settings. And at any speed, full-rated horsepower is delivered.

If there's a process in your plant that requires precise speed selection, get all the facts about compact, all-metal P.I.V. Write for Catalog 2274, or call your nearest Link-Belt office or distributor. 13.431

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office: New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

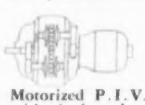
LINK-BELT

P.I.V. VARIABLE SPEED DRIVE

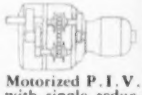
4 of 16 P.I.V. types, ½ to 25 hp — ratios to 6:1

Basic P.I.V. Like all others, it is built for horizontal or vertical mounting.

P.I.V. with single reduction input or output helical gears.

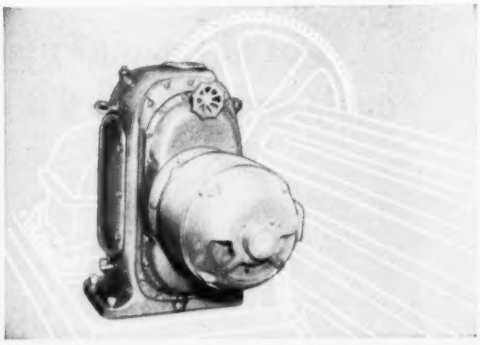


Motorized P.I.V. with single reduction input and output helical gears.

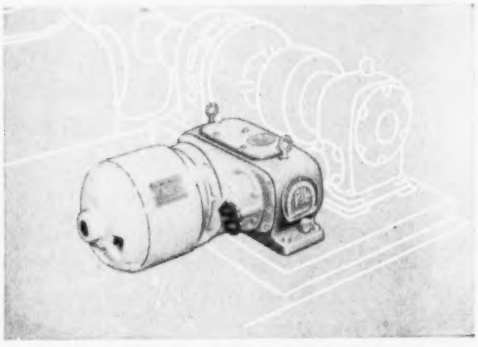


Motorized P.I.V. with single reduction input and double reduction output helical gears.

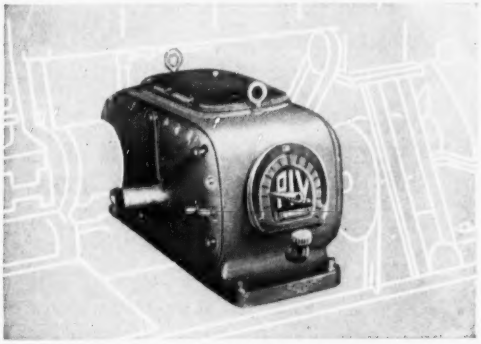
POSITIVE OPERATION OF DIFFERENTIAL SPEED EQUIPMENT. P.I.V. also provides precise regulation of rotary motion.



FLEXIBILITY IN TIMING. In addition, P.I.V. offers accurate control of processing speeds, unaffected by atmospheric conditions.



STEPLESS CONTROL OF PRODUCTION LINES OR INDIVIDUAL MACHINES, either manually or automatically, positively, dependably.



EXACT SYNCHRONIZATION OF ROTATING PARTS AND MACHINES. P.I.V. is needed where automatic sequence control must be stepless.

For more information on products advertised, use Inquiry Card, page 247

Wheel Life Increased Five Times

Wider face wheel reduces downtime, cuts abrasive cost

The Problem

Replacement of a standard cylinder wheel was necessary after grinding 1200 pieces on a rotary table surface grinder. Intermittent cuts were taken on the sides of forgings. The abrasive had a standard face width of 1½".

The Solution

The Gardner Abrasive Specialist suggested a 3" face Yellow-Rim Wire-Lokt cylinder wheel in place of the 1½" face. This wider face wheel stepped up production to 6000 pieces before replacement.

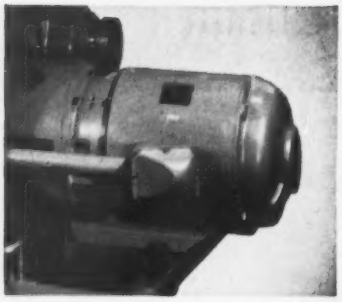
115A

Gardner Abrasive Specialists consider machine performance and then evaluate how the type of disc or grade and grain of abrasive affect your grinding results.

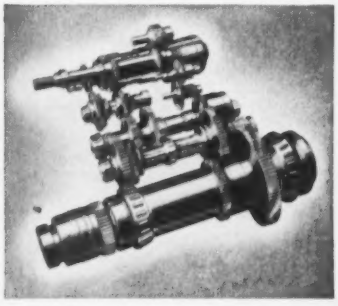
For help on *your* grinding problems, consult Gardner.

GARDNER MACHINE COMPANY
414 Gardner St., Beloit, Wisconsin, U.S.A.

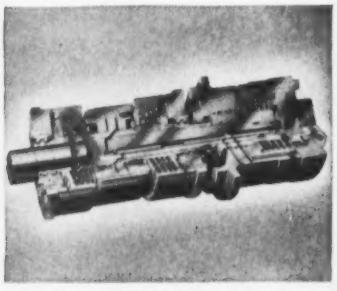
GARDNER
abrasive discs



MORE POWER – as much as you'll need for any job! Motor range: 2-A, 15 to 40 hp.; 3-A, 25 to 60 hp.; 4-A, 30 to 75 hp.

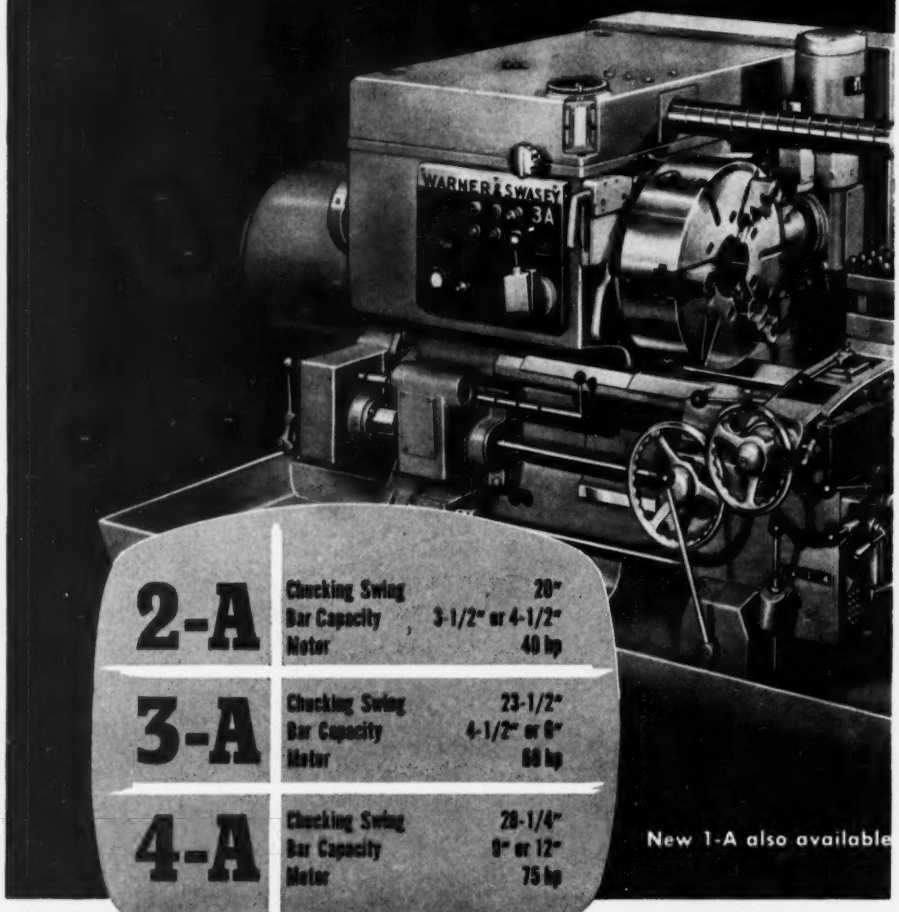


16-SPEED DRIVE provides closer grouping of speeds in natural work range to turn more work diameters more effectively – increase production and tool life. 2-speed motor provides 32 *un-duplicated* speeds!



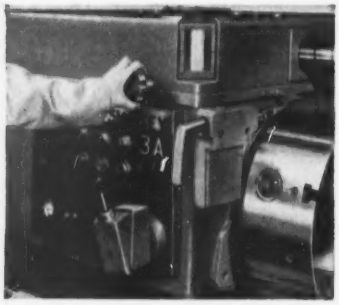
MAINTENANCE-FREE, instant-acting forward and reverse clutch and headbrake unit never needs adjustment – engage smoothly and virtually instantaneously providing fast starts, stops, and reverses.

NEW WARNER & SWASEY INCREASED EFFICIENCY, GREATER

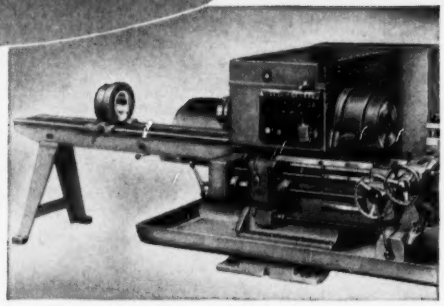


2-A	Chucking Swing	20"
	Bar Capacity	3-1/2" or 4-1/2"
	Motor	40 hp
3-A	Chucking Swing	23-1/2"
	Bar Capacity	4-1/2" or 6"
	Motor	60 hp
4-A	Chucking Swing	28-1/4"
	Bar Capacity	8" or 12"
	Motor	75 hp

New 1-A also available



SPEED PRE-SELECTION made easy by large direct reading indicator dial. AUTOMATIC GEAR SHIFTING boosts production, reduces operator fatigue. A single movement of the control handle without any further attention by the operator slows spindle to crawl speed, then shifts to new speed—all in a matter of seconds.

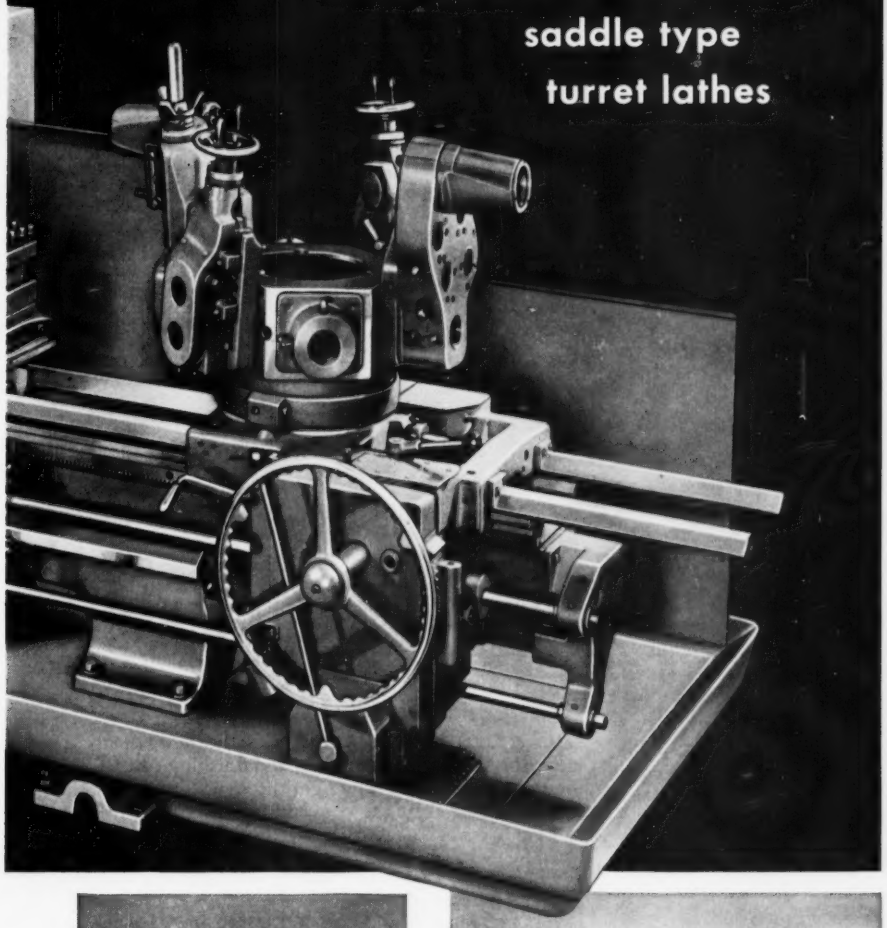


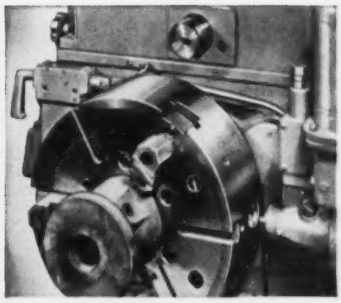
NEW HYDRAULIC CHUCK AND BAR FEED and power return. Provides easier handling, less operator fatigue – increased production.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER &

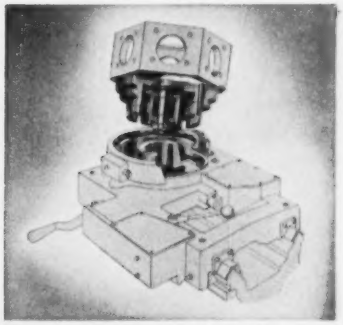
DESIGN FEATURES GIVE YOU PRODUCTION, MORE PROFITS!

A completely new line of saddle type turret lathes

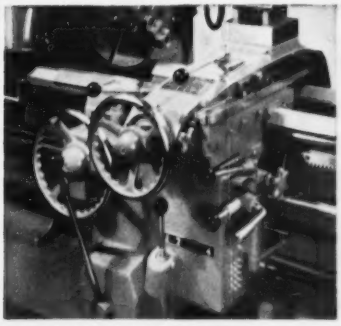




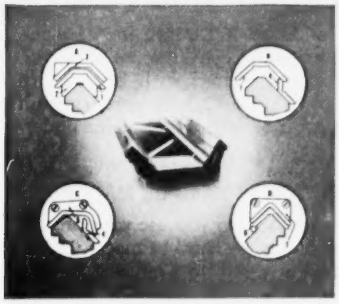
NEW POWER CHUCK WRENCH eliminates back-breaking effort when chucking. Grips and holds delicate work or heavy forgings. Does not obstruct spindle bore.



ACCURATE LOCATING AND LOCKING HEX TURRET assures maintained accuracy. Single lever controls both locating and clamping of turret.



FAST OPERATING CROSS SLIDE. All controls within easy reach. 4-way traversing with rapid traverse lever. Monoshift lever provides fast feed changes. Open type square turret for flexible tooling.



INDUCTION HARDENED VEE-BEDWAYS assure long accurate life. Exclusive way covers protect bearing surfaces from damage by dropped tools, chips, and loss of way lubrication.

INCREASED STRENGTH WITHOUT INCREASED WEIGHT. Scientific diagonal rib design gives over 30% added strength—greater rigidity and long-term accuracy.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

For more information on products advertised, use Inquiry Card, page 247

● **DISCS cut fast...on the FASTCUT Pad 85 Assembly**

NEW SAND SCREEN: Use both

TRADE MARK

SAND SCREEN by CARBORUNDUM is the new, open-mesh abrasive cloth for sanding and finishing that lets the removed material flow right through . . . instead of loading and glazing, as conventional abrasive paper and cloth do.

LASTS 7 TO 15 TIMES LONGER

Because it resists loading, and because you use *both sides*, SAND SCREEN sticks to its cutting job as much as 7 to 15 times longer than conventional abrasives. Both sides are uniformly coated with hard, sharp CARBORUNDUM® Brand Silicon Carbide abrasive grain for fast, easy sanding on metals, wood, paint undercoats and sealers.

USE IT WET OR DRY . . . BY HAND OR MACHINE

Use SAND SCREEN the same way you use your present paper or cloth—wet or dry, by hand or machine. For

Continually putting MORE SENSE in your ABRASIVE DOLLAR . . .

● **CUT SHEETS fit your air or electric vibrating sander**

● **FOLD it like paper...TEAR it like cloth**

sides...do from 7 to 15 times the work!

hand sanding, full 9" x 11" sheets fold like paper, tear like cloth to any width you desire. Cut sheets fit your oscillating or vibrating sanders. Discs give best results when used wet with CARBORUNDUM'S FASTCUT Pad 85 Assembly. Ordinarily, no adhesive is needed when sanding flats or slight contours... the surface of the FASTCUT Pad holds the disc in place. Full sheets, cut sheets and discs come in 180 and finer grit sizes.

WHERE WOULD YOU LIKE TO USE SAND SCREEN?

We will work with you to help you take full advantage of SAND SCREEN'S many advantages and cost-cutting features. Just tell us what operations you would like to test it on. Call your CARBORUNDUM Distributor or Salesman (listed under "Abrasives" or "Grinding Wheels" in the yellow pages). Or, if you prefer, write to us. Send the coupon for a sample and full details, anyway!

Send for Folder... use this Coupon!

THE CARBORUNDUM COMPANY, Dept. M 82-46
Niagara Falls, New York
Rush folder about new SAND SCREEN.

NAME _____ TITLE _____

COMPANY _____

STREET AND NUMBER _____

CITY _____ ZONE _____ STATE _____

CARBORUNDUM

REGISTERED TRADE MARK

82-46

MODEL 96-05 CHUCK WITH ITS TAPER SHANK ARBOR

MODEL 96-F1 SHOWING ITS BACK MOUNTING FLANGE

NOW! New Jacobs Model 96 Rubber-Flex Collet Chuck

brings famous grip to whole new group of applications

Grinders! Milling machines! Jig borers! Jig grinders! Lathes! Various types of special machinery where precise compact collet closure is vital!

ALL get the benefit of the famous Jacobs Rubber-Flex Collet grip in the new Jacobs Model 96 Collet Chuck.

The long, steel jaws of this collet — locked together with oil-resistant synthetic rubber — provide an absolutely parallel grip over the entire bearing surface.

What's more, each collet has a full ⅛" range so that the standard set of eleven Rubber-Flex Collets cover the gripping range of eighty-eight split steel collets! A geared key tightening device and self-tightening toggle action of the collet jaws give the chuck gripping power far beyond that obtained with split steel collets. Chucks any diameter bar between 1/16" and 1⅜".

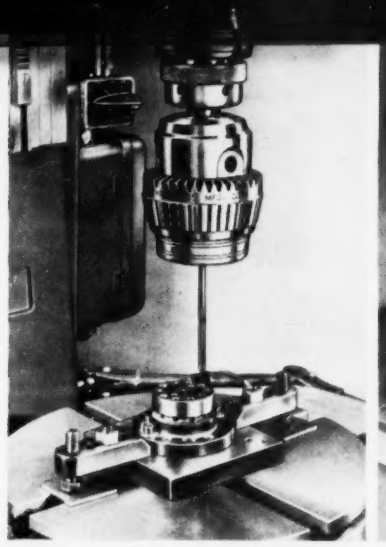
For work holding: Model 96 Collet Chuck permits precision chucking of bright finished bars, with close or wide tolerance diameters, resilient or compressible materials, tubing and brittle materials such as ceramics or glass.

For tool holding: Model 96 Collet Chuck can be used for drilling and reaming on jig borers and other high precision machines, holding proving bars and indicators. Extreme accuracy and wide capacity range make it ideal for tool and cutter grinding on cylindrical and cutter grinders.

TWO MODELS: Model 96-05, $135.00; Model 96-F1, $150.00. Rubber-Flex Collets, $12.00 each.

For further details, ask your Industrial Supply Distributor for Catalog 54-CC. The Jacobs Manufacturing Company, West Hartford 10, Conn.

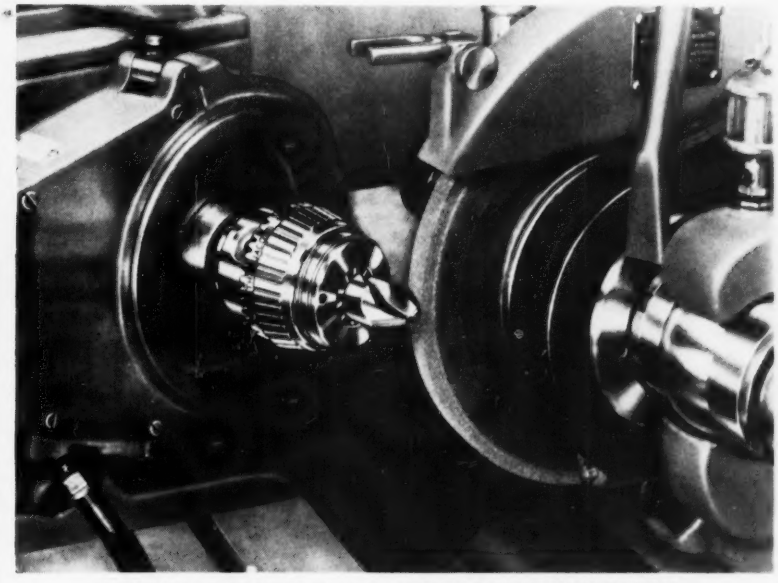
Jacobs RUBBER-FLEX COLLETS



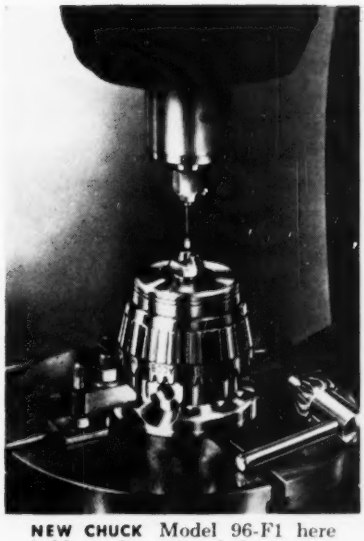
PRECISION REAMING ON JIG BORER with Model 96-05.

NEW JACOBS MODEL 96-F1 COLLET CHUCK on magnetic chuck holds work for surface grinder.

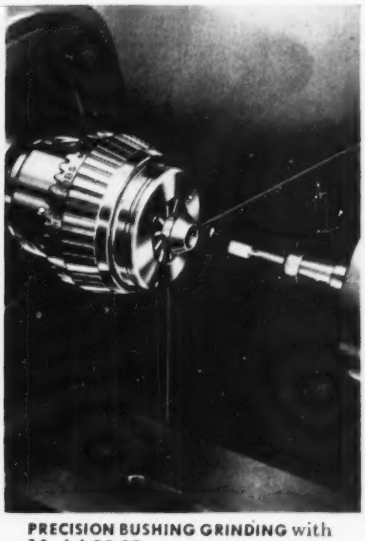
CHUCKING WORK ON VERTICAL MILLING MACHINE with Model 96-F1.



MODEL 96-05 ADAPTED TO HEADSTOCK OF CYLINDRICAL GRINDER.



NEW CHUCK Model 96-F1 here holds work on jig grinder.



PRECISION BUSHING GRINDING with Model 96-05.

IF IT'S A

JACOBS

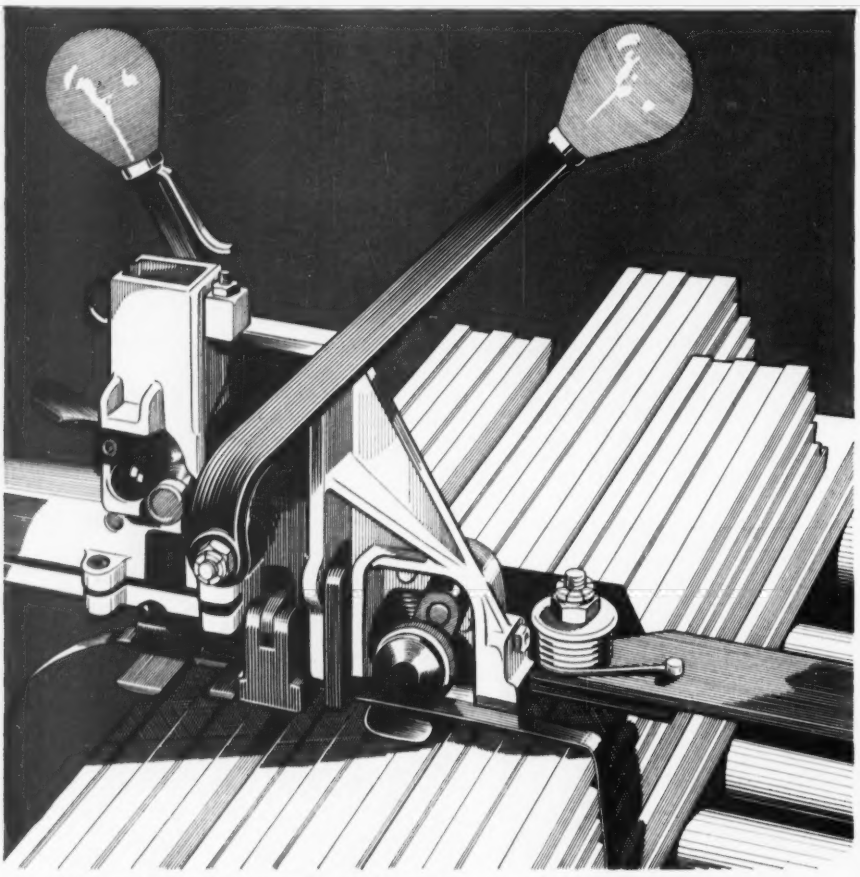
IT HOLDS

Jacobs and your local distributor

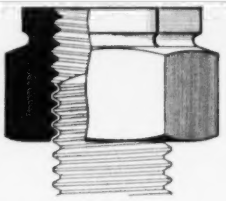
are ready to deliver the chucks you need and the service you deserve.

. . . first in chucks

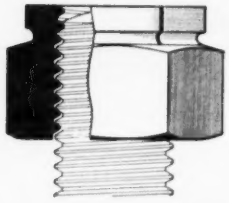
. . . first in service



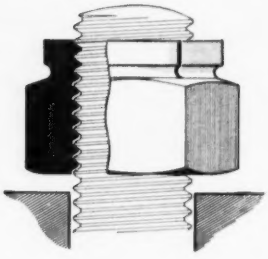
Wherever assemblies must be held together—on metal strappers or dishwashers—more and more original equipment manufacturers and maintenance men are relying on FLEXLOC locknuts for safe, dependable locking.



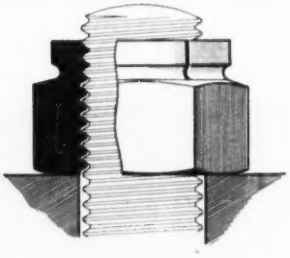
Starting. A FLEXLOC starts like any ordinary nut. Put it on with your fingers. Tighten it with a standard hand or speed wrench.



Beginning to Lock. As the bolt enters the segmented locking section, the section is expanded, and the nut starts to lock.



Fully Locked As a Stop Nut. When 1½ threads of a standard bolt are past the top of the nut, the FLEXLOC is fully locked. A FLEXLOC does not have to seat to lock.



Fully Locked As a Seated Nut. When it is used as a lock or stop nut, the locking threads of the FLEXLOC press inward against the bolt, lifting the nut upward and causing the remaining threads to bear against the lower surface of the bolt threads. Vibration will not loosen a FLEXLOC, yet there is no galling of threads.

Why are more and more FLEXLOC locknuts being used to hold assemblies together?

There are a number of reasons. FLEXLOCs are one piece, all metal—no lockwashers to break, no cotter pins to shear, no auxiliary locking devices to deteriorate. FLEXLOCs stay put wherever you place them—as stop nuts or seated nuts—once their locking threads are fully engaged. Because they won't work loose, they reduce costly service calls. FLEXLOCs have higher tensile, are stronger than most other locknuts. And they withstand temperatures as high as 550°F.

FLEXLOCs have the additional advantage of reusability. They can be applied again and again without loss of efficiency. Because they are safe and dependable, you'll find more and more FLEXLOCs being used where vibration is severe—on automotive equipment, compressors, machine tools, household appliances, high-speed looms, aircraft.

FLEXLOCs are available in a wide range of sizes in any quantity. Stocks are carried by leading industrial distributors everywhere. Write for literature and samples for test purposes. STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

FLEXLOC® LOCKNUT DIVISION

SPS
JENKINTOWN PENNSYLVANIA

For more information on products advertised, use Inquiry Card, page 247

Tests Prove That CIMCOOL With "95-16" Doubles Rust-Control

This is not a "blue-sky claim"! Actual scientific laboratory and shop tests prove that CIMCOOL° with "95-16" *doubles rust-control* compared with a formula without this amazing ingredient.

But doubling rust-control is *just one of many reasons* why more and more plants are switching to CIMCOOL. This radically new and different coolant—this *chemical emulsion*—saves you money many important ways. Plant after plant reports that CIMCOOL covers 85% of all metal cutting jobs . . . and does a better job. It permits faster speeds because it combines friction reduction and cooling capacity in a degree never before attained by old-fashioned coolants. It's longer lasting in machines. So CIMCOOL reduces downtime and cuts labor costs for cleaning and changing.

Let us prove to you what scientific tests and on-the-job experience have already proved. Put CIMCOOL to the test in your own plant—on your own machines. For a demonstration write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

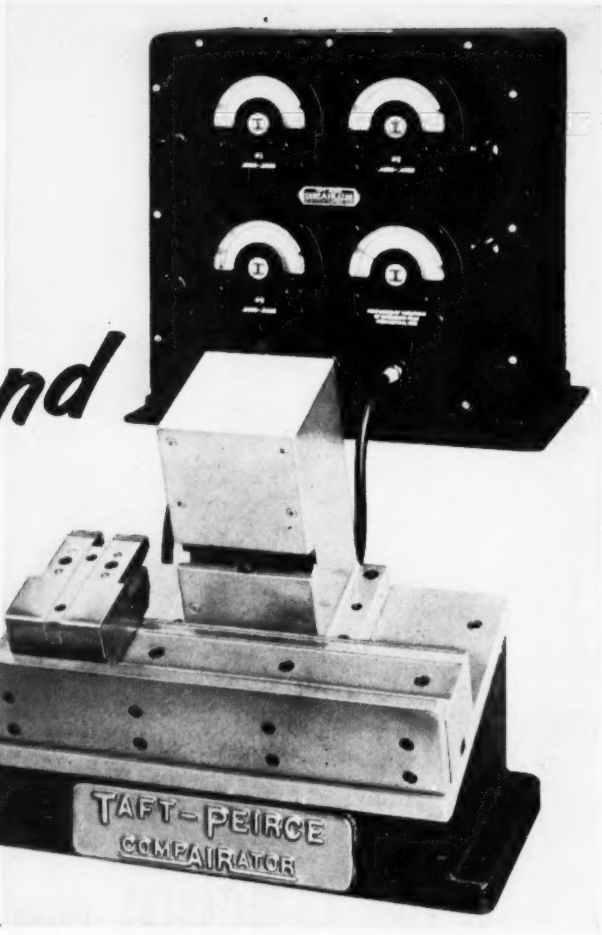
CIMCOOL

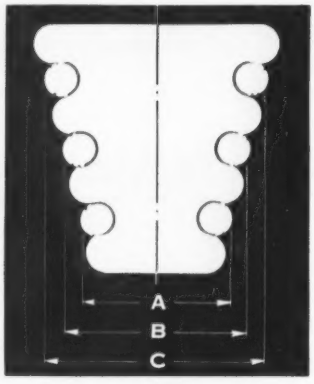
A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

New Taft-Peirce CompAIRator Air Gage

Measures and Computes

4 DIMENSIONS SIMULTANEOUSLY



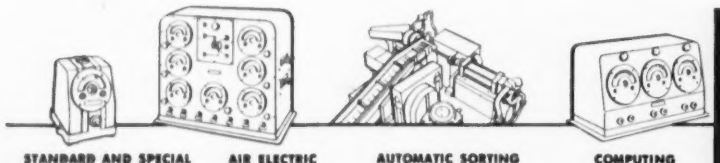


The CompAIRator above checks serrations in the root section of jet engine turbine blades. Does automatically and instantly what formerly took skilled hands many minutes to do.

Three of the air indicators measure thickness "over rolls" of the serrated sections. At the same time, a T-P Computing CompAIRator computes the difference between two of these dimensions and compares it to a standard value. If the variation is greater than plus or minus .001″ on the dial, the part is rejected. Most important of all, the serrations can be checked over their entire length.

Two different models of this gage have been built. One permits gaging with the part in the grinding fixture — thus eliminating many costly rejects. The other serves as a final inspection gage.

This unit is typical of the hundreds of Taft-Peirce CompAIRators now simplifying complicated gaging operations. For more information on this and many other items, send for your copy of the Taft-Peirce Handbook.



STANDARD AND SPECIAL COMPAIRATORS | AIR ELECTRIC COMPAIRATORS | AUTOMATIC SORTING MACHINE | COMPUTING COMPAIRATORS

T-P means Top Precision

T P

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, R. I.

For more information on products advertised, use Inquiry Card, page 247

Production Pointers from GISHOLT

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help you cut time and costs in your own work.

MACHINING DIFFERENTIAL CASES *ON A FAST, AUTOMATIC BASIS*

3 Operations Total 2.4 Minutes

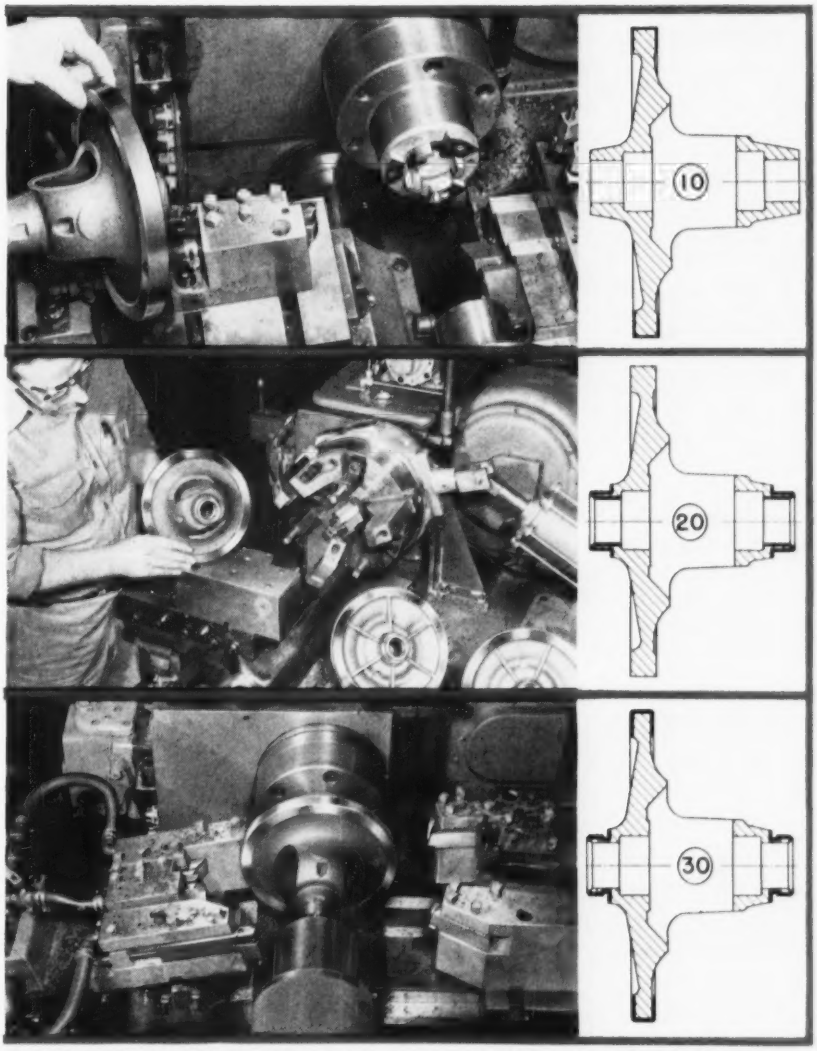
It takes three separate machining operations to turn these castings into finished tractor differential cases. To make a fast job of it, production is handled by these three No. 12 Hydraulic Automatic Lathes...and just one man.

1st Operation—0.6 Minutes
This rough machining prepares parts for holding and locating in subsequent operations. Bell-type centers in the tailstock and spindle line up hub diameter at each end. Longitudinal location is taken care of by a positive stop. A single tool on the front carriage turns the flange, while two tools on the rear slide straddle face.

2nd Operation—0.9 Minutes
Part is now held on OD with a Gisholt-Barker air-operated chuck. This chuck leaves the spindle open to carry tools to bore, face, turn and chamfer the hub. Similar tools mounted on the front carriage handle the same surfaces on the other end.

3rd Operation—0.9 Minutes
Workpiece is held back and driven with an air-operated clamp and a serrated C-washer. Tools on front carriage turn both hubs, as well as finish turn the flange OD and chamfer both corners. Tools on the rear slide form the grinding relief, chamfer both hubs and finish straddle face the flange.

These complex parts, with 16 inside and outside surfaces at both ends, are machined in a rapid, pass-along sequence.



THE AMAZING VERSATILITY of this machine is illustrated by 28 different jobs in the *No. 12 Hydraulic Automatic Lathe* catalog. Write for your copy.

GISHOLT

TIME-SAVING IDEAS

HOW GOOD "HEAD" WORK MAKES THIS A ONE-PASS OPERATION

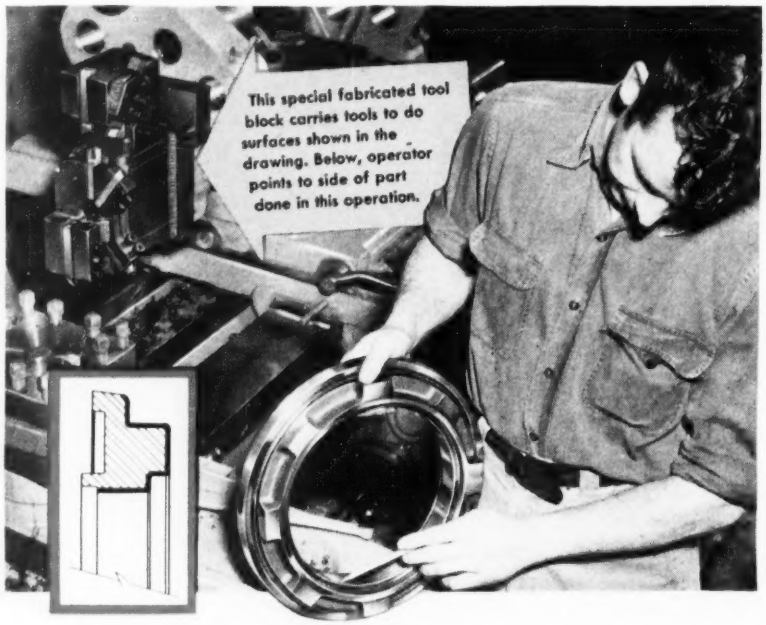
Combined Tooling Saves Time

It's heavy work with plenty of metal to be removed in the machining of these flanged ring steel forgings. So there's 60 horsepower put into the 3L Saddle Type Turret Lathe that does the job.

A newsworthy feature of the setup—and a good point to remember for your own work of this kind—is the massive combination tool holder which carries seven tools. Securely mounted on the hexagon turret, this special head combines tools for plunge cutting the surfaces shown in the drawing in a single pass. Floor-to-floor time is 2.5 minutes, much faster than what it would be with a conventional tooling arrangement.

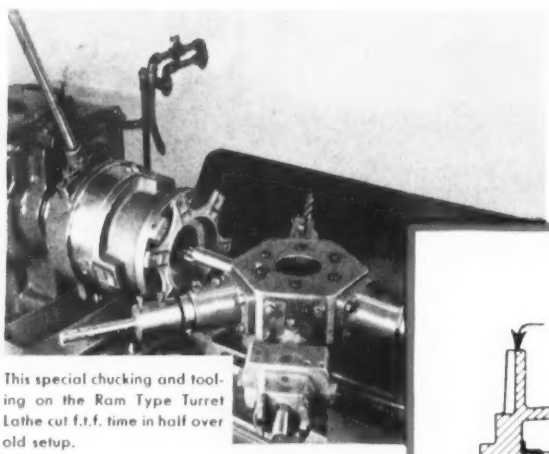
You can be sure that the tools mounted in this strong, fabricated head are there to "stay." There's no overhanging of tools this way, no springing problems. Work of this kind, to do it right...and fast...takes plenty of power and rigidity in a machine. They have it here in the rugged Gisholt 3L Saddle Type Turret Lathe.

By combining 7 tools in one special head, all surfaces are handled in one powerful plunge cutting operation.

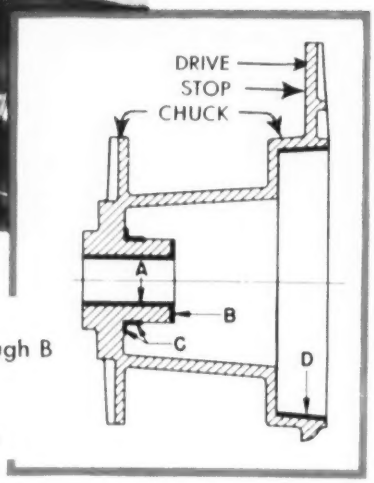

This special fabricated tool block carries tools to do surfaces shown in the drawing. Below, operator points to side of part done in this operation.

CLEVER CHUCKING IDEA HELPS DOUBLE PRODUCTION

Also Assures Concentricity of Long Workpiece



This special chucking and tooling on the Ram Type Turret Lathe cut f.t.f. time in half over old setup.



Station 1—Rough A
Station 2—Finish A, rough B
Station 3—Ream A
Station 4—Rough C-D
Station 5—Finish B-C-D

Here the production trick is holding these cast-iron hub spiders. Because of the long overhang, chucking had to be planned for support at both ends of the workpiece. Yet, fast loading and unloading were a must, too.

All problems are nicely solved by the No. 5 Ram Type Turret Lathe equipped with a 3-jaw Gisholt-Barker Wrenchless Chuck. This provides for fast loading operations, and yet allows a large enough bore to carry a pilot bushing for added support during boring.

A special fixture locates and drives at the spider end. Chuck jaws, free to move through openings at the back of the housing, hold on the small flange end. Balanced and piloted tools on the hexagon turret handle all the surfaces shown.

Time on this machine with good tooling and chucking is now only 3.2 minutes—just half the time of the former method.

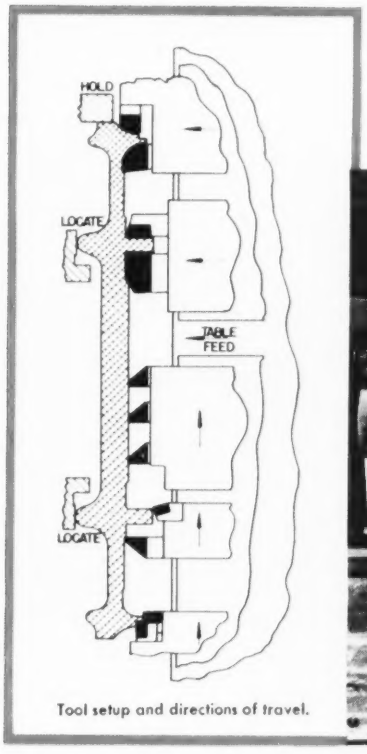
Here, fine, fast chucking with good tooling for rapid stock removal has doubled production.

GISHOLT

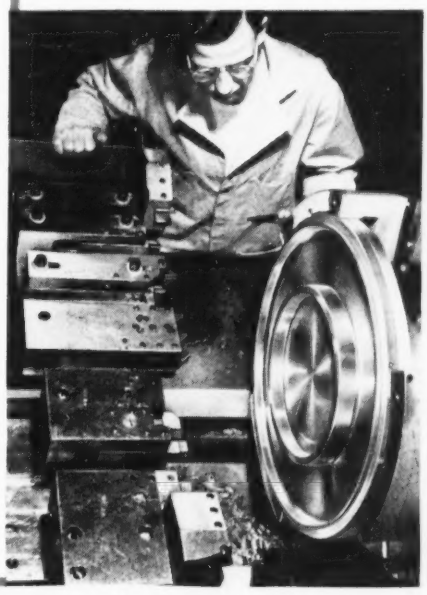
TIME-SAVING IDEAS

MANY SURFACES AND SIZES NO PROBLEM...*THIS WAY*

Simplimatic Provides Automatic Operation on Jet Engine Part



Tool setup and directions of travel.



Setting up this jet engine job had its problems: how to handle the many surfaces of the compressor discs in nine different sizes.

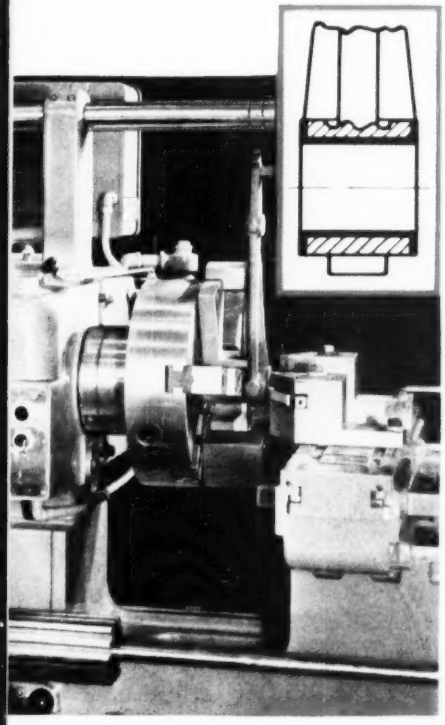
The solution was provided by a Simplimatic Automatic Lathe. Seven tools on the front slide feed longitudinally to depth and then across for facing and turning. Four tools on the rear slide move longitudinally to finish the turning and boring and to form the four radii. A 50-horsepower driving motor is required. Floor-to-floor time is approximately 13 minutes.

The drawing shows how each slide with its group of tools feeds at its own direction and rate of feed. This permits you to get more combinations of surfaces in a single tooling setup. It's the reason why so many different jobs can be handled on the Simplimatic—and at a cost far below that of a special machine.

Nine sizes of similar parts are easily handled by simply repositioning tools in the T-slots using the same slide positions and motions.

GOOD TIPS IN HOLDING AND MACHINING BIG-SWING PARTS

Fastermatic Provides Efficient Production of 18 Similar Workpieces



Close-up shows chucking detail. Front and back faces and the ID are machined in one operation.

There's more here than meets the eye. While the drawing shows simple multiple machining, there are definite problems in holding this part (and seventeen others) having considerable swing.

To do the job in one fast, automatic operation a 1F Fastermatic Automatic Turret Lathe was chosen because of the multiple passes it makes possible. To take care of the big swing, the lathe bed was gapped as shown.

The real problem—of holding the various parts without going into special, expensive fixtures—was solved by a 2-3 jaw convertible chuck. Chucking is done with either two or three jaws, depending upon available chucking surfaces. To get a firm grip on the contoured chucking surfaces, jaw inserts are used.

There is simple turret and cross slide tooling with a back-facing attachment mounted inside the spindle. This permits doing all surfaces from both ends in a single, completely automatic cycle. Floor-to-floor time for a part with an 18″ swing is 4.7 minutes. The other seventeen parts are handled just as efficiently.

An unusual job with smart chucking permits machining these awkward, long-armed parts complete in one operation.

TIME-SAVING IDEAS

SUPERFINISHER MOUNTS ON GRINDER ...SAVES REFINISHING COSTS

Smooth Surfaces Make Pump Piston Rods Last Longer

Here is a fresh approach to an old problem—rebuilding worn pump piston rods.

First, the piston rod—from a reciprocating chemical pump—is placed in a grinder. The long shaft is then ground down to the top limit of undersize dimension. At this point, the surface finish measures approximately 15 micro-inches. The grinding wheel is retracted and with a No. 3 Superfinish Attachment mounted on the grinder, the surface is quickly Superfinished down to 5 micro-inches. Work is done in lots of six to ten pieces.

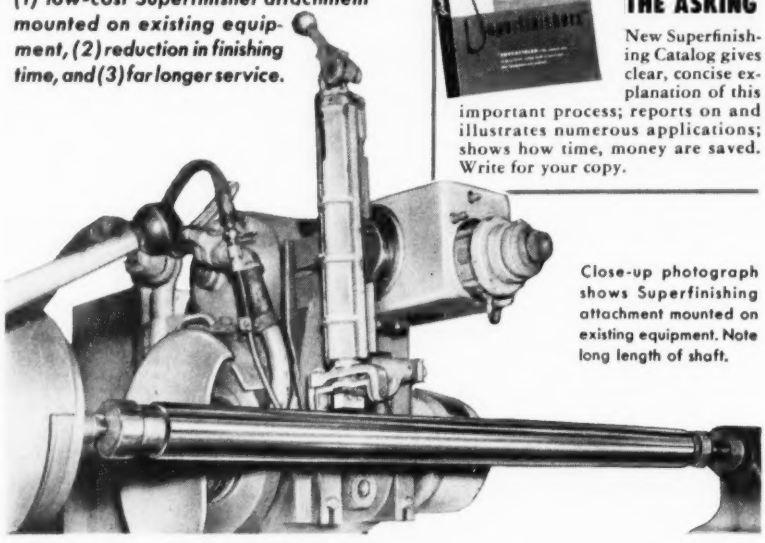
Two important benefits result: finishing time is cut in half with very little cost for new equipment; greatly increased service life is achieved with far less seal replacement.

In this better way of refinishing pump piston rods, money is saved by the (1) low-cost Superfinisher attachment mounted on existing equipment, (2) reduction in finishing time, and (3) far longer service.

NEW!

YOURS FOR THE ASKING

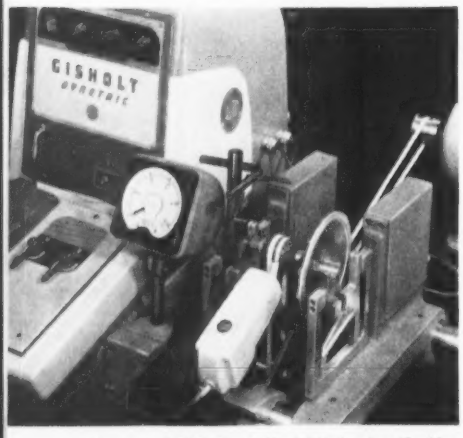
New Superfinishing Catalog gives clear, concise explanation of this important process; reports on and illustrates numerous applications; shows how time, money are saved. Write for your copy.



Close-up photograph shows Superfinishing attachment mounted on existing equipment. Note long length of shaft.

HOW "FORCE" UNBALANCE IN ASSEMBLY IS LOCATED AND MEASURED

Correction Made by Addition of Single Weight



Improved 1SB Bench Model Balancing Machine with workpiece loaded.

Precision balancing amounts to a real sales advantage in this case... vacuum cleaners. The manufacturer first dynamically balances the armature and then the armature-impeller assembly. Long life with smooth, quiet operation is the result.

Production is handled on a Gisholt 1SB Bench Model DYNETRIC Balancer. In this case, because the impeller is small in axial length compared in diameter, major unbalance after assembly with the armature will be *force* (static) unbalance, as opposed to *moment* (dynamic) unbalance.

The assembly is placed in a special cradle which permits it to rotate on its own bearing surfaces. Amount of force unbalance is shown on the direct-reading Amount Meter; and angular location is simultaneously indicated on the numbered band by the stroboscopic lamp unit.

Correction of force unbalance requires the addition of a single correction weight. Time in making correction is therefore saved by the Gisholt Balancer because it provides separate measurement of force and moment unbalance. On jobs where moment unbalance stops within an established tolerance for most pieces in the lot, this kind of operation results in even lower balancing costs.

By showing force unbalance separately, correction time is saved by Gisholt Dynetric Balancers.

DYNETRIC BALANCERS GISHOLT

DEVELOPED JOINTLY WITH WESTINGHOUSE ELECTRIC CORPORATION "DYNETRIC" IS A TRADE MARK REG. U. S. PAT. OFFICE BY WESTINGHOUSE ELECTRIC CORPORATION

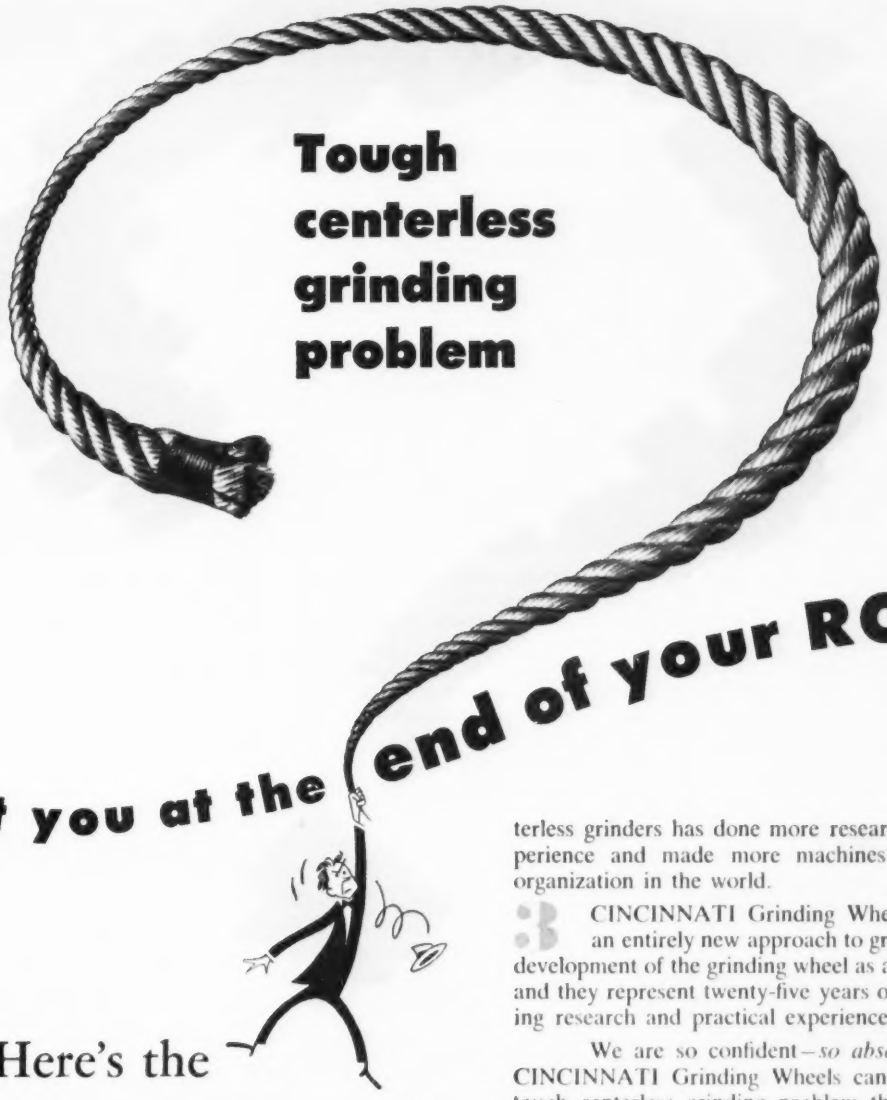
No. 5-654
625

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Write for your copy of Gisholt's new general catalog.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



Here's the grinding wheel that will ABSOLUTELY solve it!

CINCINNATI Grinding Wheels can help you untie the knots in that tough centerless grinding problem: BECAUSE CINCINNATI WHEELS ARE MADE TO TEAM-UP WITH CENTERLESS GRINDERS!

And with a Cincinnati Milling-trained machinist on the spot to help you get the most out of CINCINNATI Grinding Wheels, you can count on the *right answer*—FAST!

Look at the reasons why we're so *positive* that CINCINNATI Wheels can help you:

1 We've solved hundreds of centerless grinding problems involving high stock removal, good finish, accurate sizing, and high production per dressing, by using the right CINCINNATI wheels.

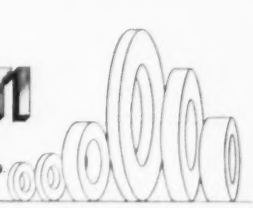
2 CINCINNATI Grinding Wheels were developed by Cincinnati milling, which in the field of centerless grinders has done more research, had more experience and made more machines than any other organization in the world.

3 CINCINNATI Grinding Wheels are based on an entirely new approach to grinding wheels, the development of the grinding wheel as a true cutting tool, and they represent twenty-five years of Cincinnati Milling research and practical experience.

We are so confident—*so absolutely sure*—that CINCINNATI Grinding Wheels can help solve your tough centerless grinding problem that we make this *unconditional offer:* either you must be completely satisfied, or we will issue full credit for the CINCINNATI Grinding Wheel used.

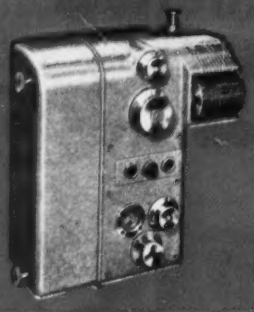
So contact us at once. We'll send one of our expert machinists—men who are Cincinnati Milling-trained and know grinding and grinding machines as well as grinding wheels. He can show you how to get the most out of CINCINNATI Grinding Wheels and help you solve that tough centerless grinding problem. There is no charge for his service. Write, wire or phone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

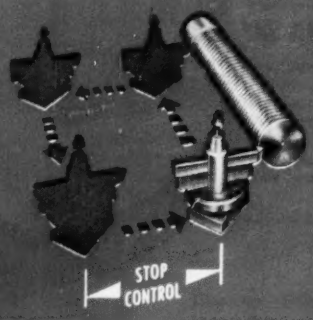
CINCINNATI
Grinding Wheels
THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio



way back in 1941 the LeBlond RT Lathe

13 years ago, LeBlond's RT Tool Room Lathe with these major



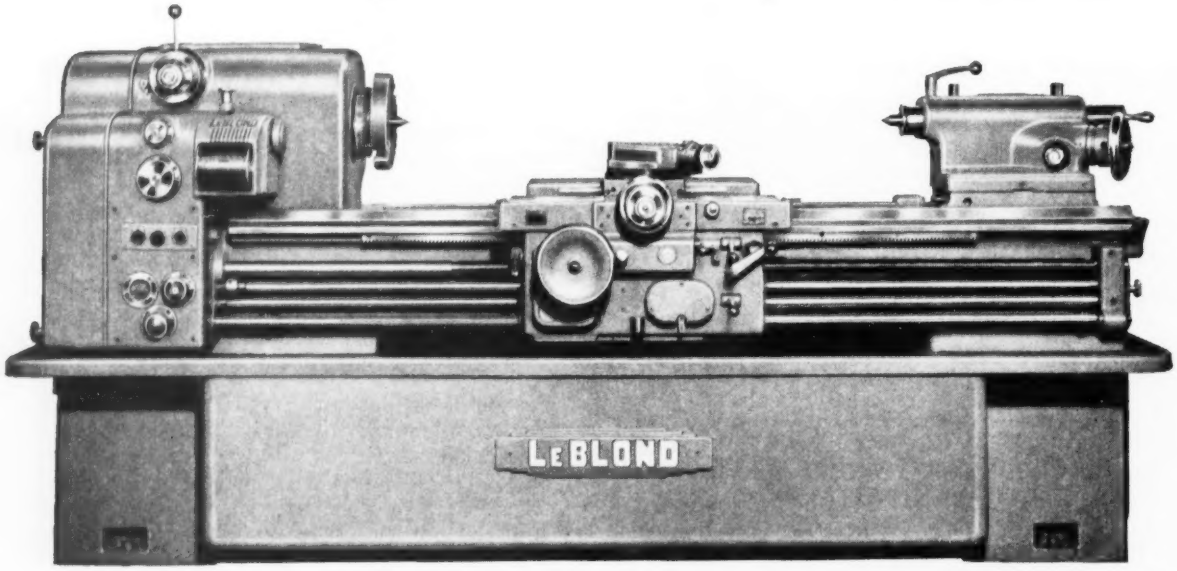


Satin-smooth Power Rapid Traverse to the carriage and cross slide plus pick-up traverse to the tailstock. No jerking, jolting or jumping. Gives you the most in operator convenience as an integral part of the apron. First developed by LeBlond in 1935.

Automatically Positioned Leadscrew and Rod Supports perfected in 1923.

A Universal Quick-change Box with 90 feeds and threads in two ranges. You can cut from 120 threads to ¼ thread per inch — without setting pick-off gears, mounting a sub-head or using any other attachment. Diametral pitch threads, leads in inches, millimeter leads and module pitch leads also can be cut by making a slight gear change. Put into production by LeBlond in 1937.

Automatic Chasing Stop, used primarily for cutting threads, limits cross slide travel positively and accurately. Makes possible speedy chasing, since cross and length power rapid traverse can be used to bring cross slide quickly back to exact starting position for each pass.

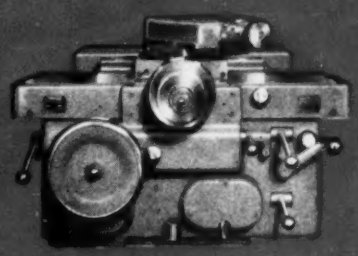


Condensed RT Lathe Specifications:

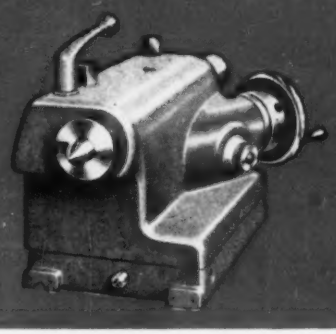
Swing over bed and carriage wings	18½"
Swing over compound rest	11½"
Distance between centers, base length	30"
Spindle speeds, range, rpm	
Low back gear	6 to 60
High back gear	30 to 300
Direct belt drive	150 to 1500
Feed and thread changes	60 regular 30 coarse
Feeds, range	.0007-2.064 ipr
Threads per inch, range	2 - 120 regular ¼ - 1⅛ coarse
Floor space required	96" x 48"

had today's Most Wanted Features

advancements set the standard for lathes today.



RT Combined Feed Apron with built-in Taper Attachment achieved in 1939. Cuts gradual or steep tapers with the larger dimension either towards the tailstock or headstock—without special machine set-ups.



An Exclusive Off-set Handwheel Tailstock employing a worm-and-rack construction for positive-position locking, greater operator convenience plus Hollow Tailstock Spindle adaptability. Equipped with a direct-reading spindle travel indicator.

And in 1946, the ***Variable-voltage Speed Control*** was incorporated into the head to provide over 300 spindle speeds in three ranges controlled by a single lever.

After five years in development and four years of on-the-job testing in LeBlond's production line, Industry met for the first time the 16″ RT Tool Room Lathe at the 1947 National Machine Tool Show. There the RT's spectacular features—far ahead of their time—caused a flurry of comment about its amazing versatility. This lathe could do almost anything.

Only within the last few years have tool engineers throughout the lathe industry built into their lathes those features of the LeBlond RT Lathe that were "new" back in 1935 . . . in 1937 . . . in 1941 . . . in 1946. Features that made the RT Lathe famous for the ability to handle almost any job without time-wasting special machine set-ups. Even in 1947, there were many who felt their tool room requirements were not varied enough for them to take full advantage of the RT's vast potential.

By adopting those early RT features on their current models, lathe makers acknowledge the greatness of LeBlond's RT Tool Room Lathe, conceived *almost 18 years ago.*

THE R. K. LEBLOND MACHINE TOOL CO., CINCINNATI 8, OHIO

For a detailed description of the LeBlond 16″ RT Tool Room Lathe and the lower-priced 16″, 16-speed RT Engine Lathe, send for Bulletins RT-31D and HD-31D

turned faster by

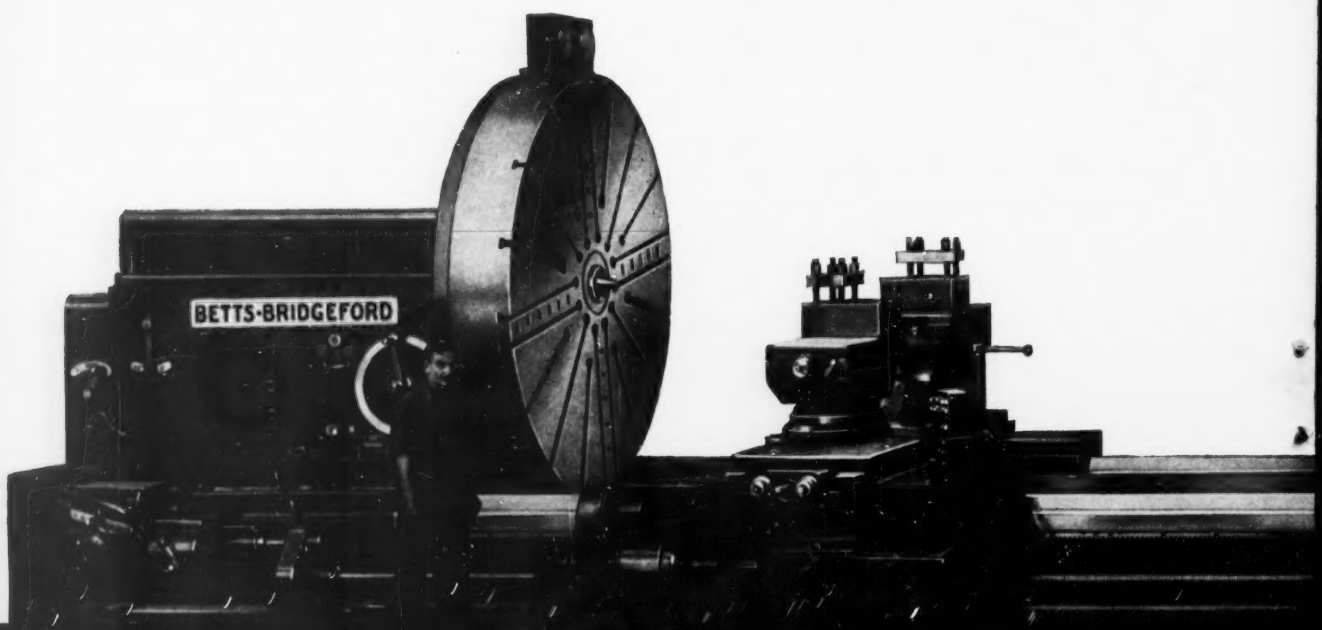
LeBLOND *of Cincinnati*

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES—FOR OVER 64 YEARS.

For more information on products advertised, use Inquiry Card, page 247

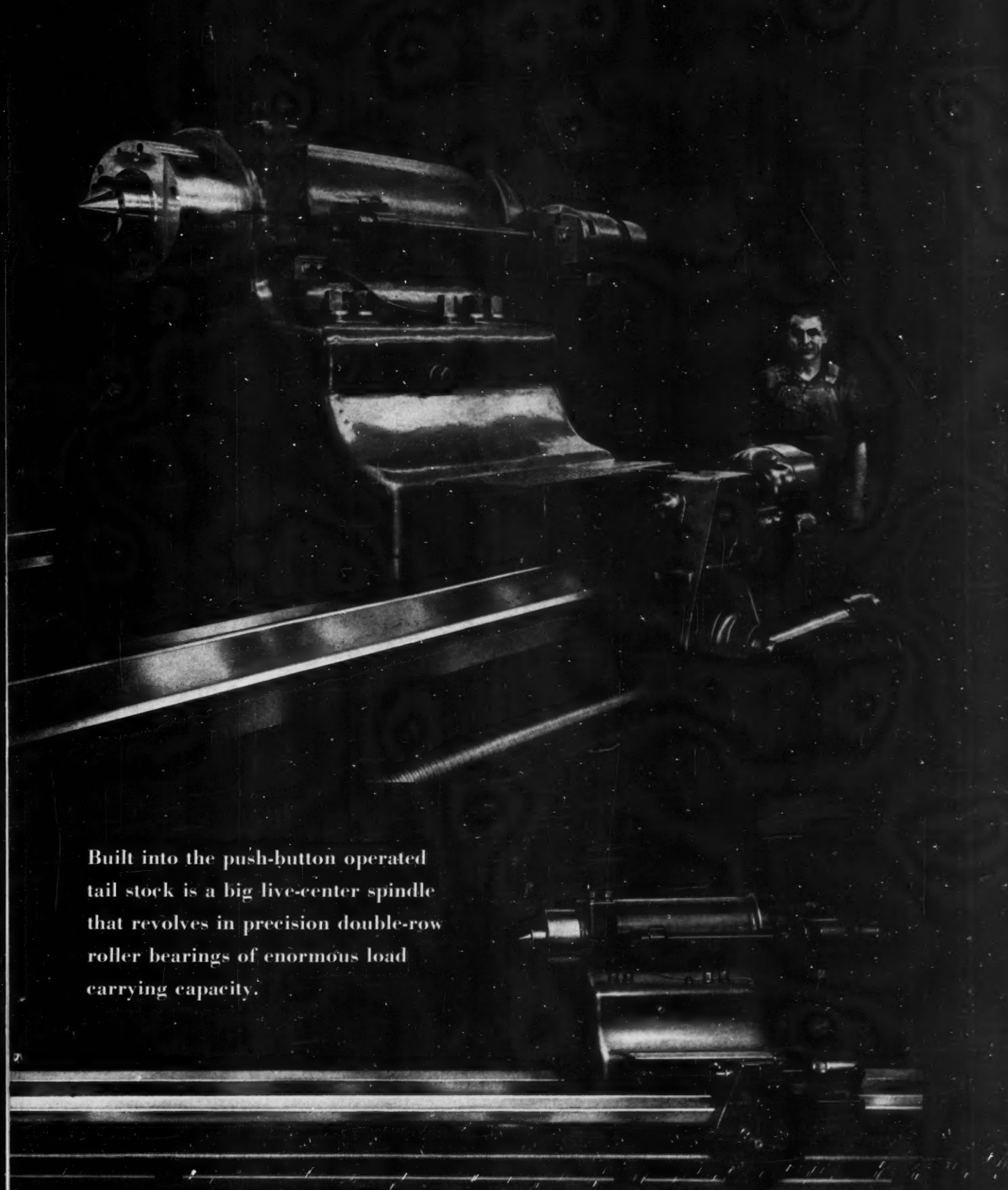
Another Big One!

A 96 Inch Heavy-Duty Betts-Bridgeford Lathe for the precision turning of forged steel steam turbine shafts weighing up to 90 tons!



CONSOLIDATED MACHINE TOOL

Wholly owned subsidiary of Farrel-

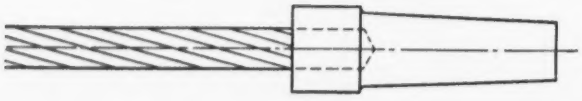


Built into the push-button operated tail stock is a big live-center spindle that revolves in precision double-row roller bearings of enormous load carrying capacity.

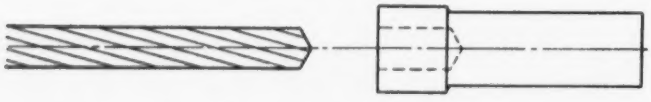
CORPORATION, ROCHESTER, N. Y.

Birmingham Company, Incorporated

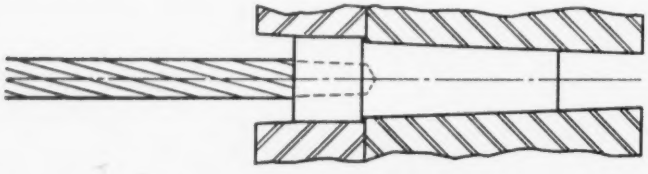
Cable Swaging... Clean, Quick, Economical



An electrical equipment manufacturer wanted a way to fasten terminals to cables—a way that would give perfect bonding—a way that was cleaner and faster than soldering or brazing.



Torrington's swaging experts showed him how to attach terminals to cables by one fast rotary swage.



Result: a clean, secure joint between cable and terminal, and accurate sizing of the plug end of the terminal at the same time.

Look at the savings that swaging can bring!

1. Savings in material and equipment—no solder, no brazing or dipping equipment needed.

2. Savings in labor—swaging can be done by unskilled personnel.

3. Savings in time—swaging is fast, clean and precise.

For more information on swaging as a method of bonding or reducing metals write for our informative booklet. It contains complete descriptions of the Torrington Rotary Swagers and may give you some ideas for a "swaging success story" in your own plant.

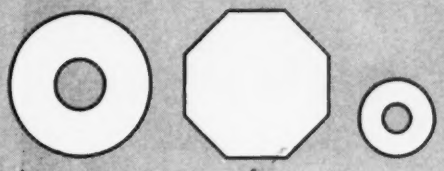
THE TORRINGTON COMPANY
Swager Department
300 North Street, Torrington, Conn.
Makers of Torrington Needle Bearings

TORRINGTON ROTARY SWAGING MACHINES

For more information on products advertised, use Inquiry Card, page 247

GARDNER
precision disc Grinders

Grinding TWO Parallel Sides of 114 sq. in. Steel Disc In ONE Operation



WORK DATA

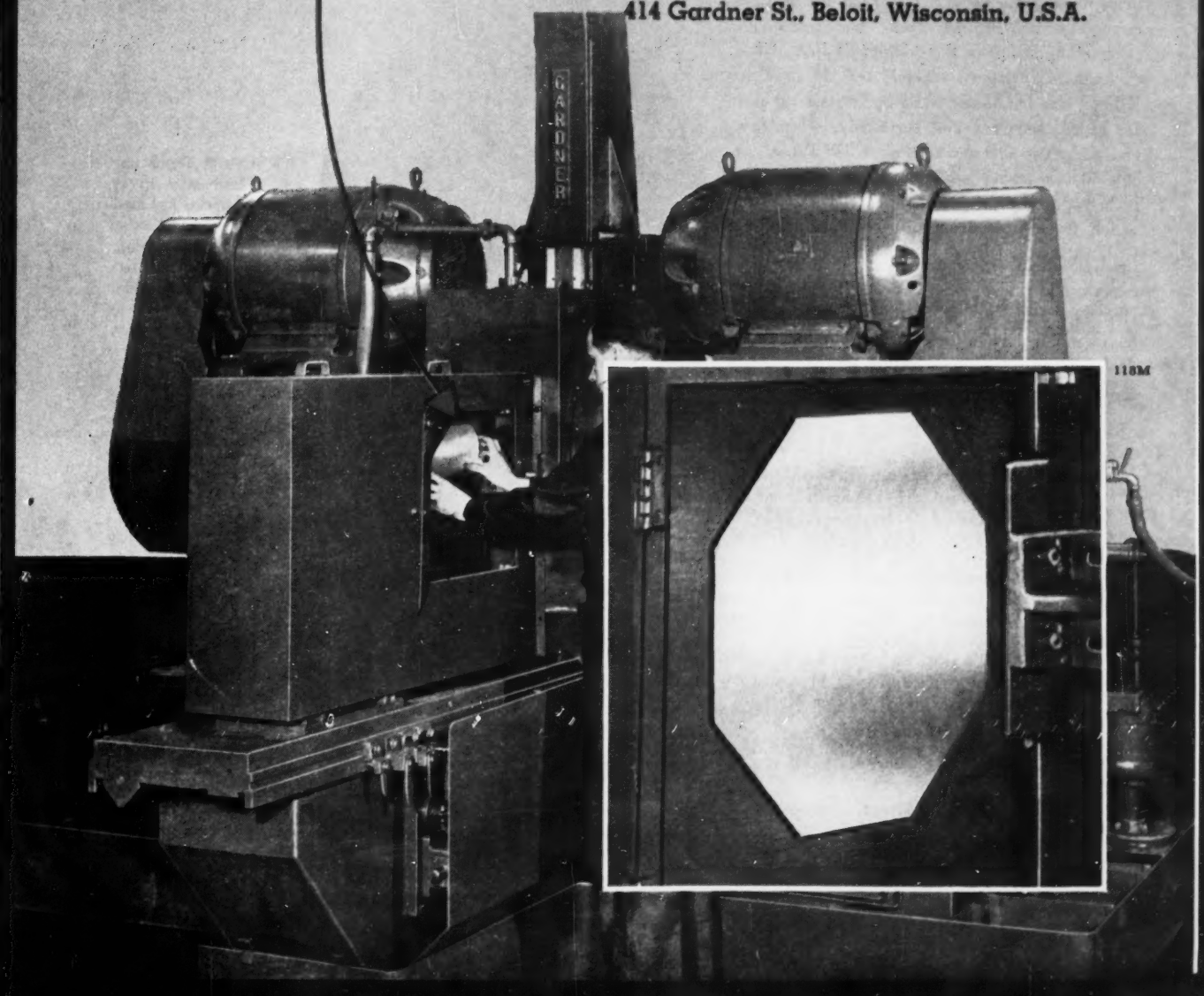
OPERATION—Grinding parallel sides of test billets to produce finished surface before etching for steel analysis.

STOCK REMOVAL—3/16" to 1/4" overall.

TOLERANCE—.006" to .008" for uniformity. .003" to .006" for parallelism.

Consult Gardner about your flat surfacing problems. Production estimates and tooling suggestions will be furnished from your work prints.

GARDNER MACHINE COMPANY
414 Gardner St., Beloit, Wisconsin, U.S.A.

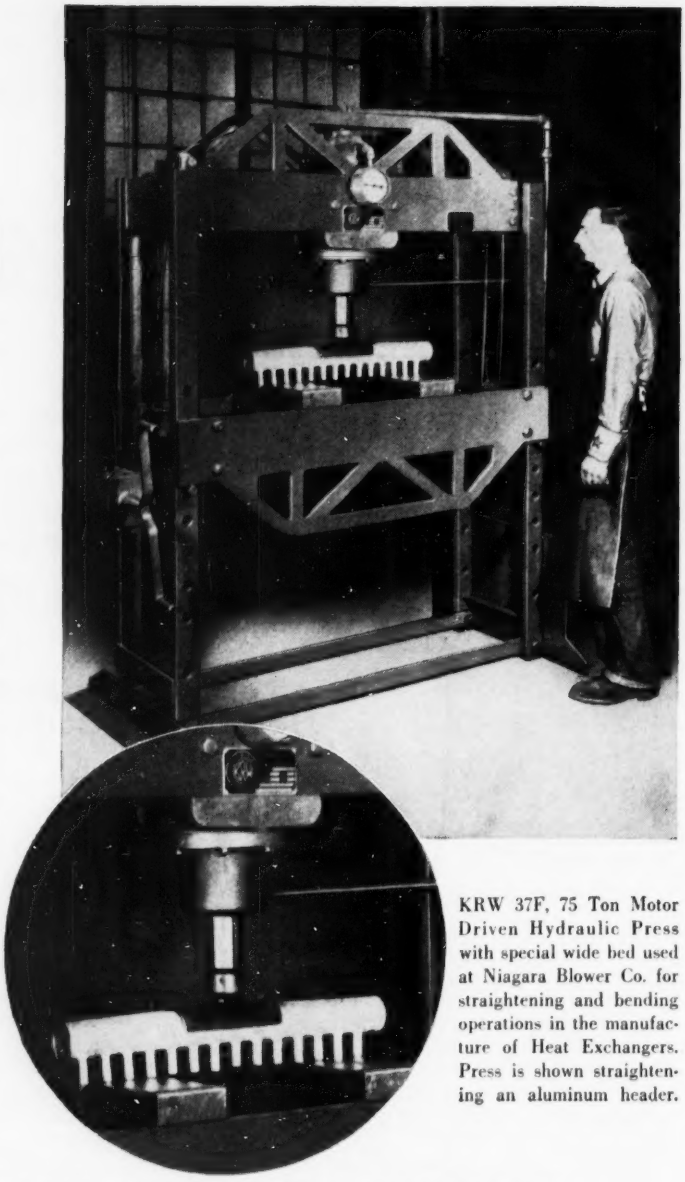


118M

Another KRW HYDRAULIC PRESS living up to it's reputation!

Like most metalworking plants, Niagara Blower Co. has a number of straightening problems in their operations — pieces that warp or bend out of shape after punching or welding. And Niagara solves these problems with this KRW motor-driven hydraulic press. It is used for straightening headers, header ends, bar irons, and other components of the company's line of heat exchangers. Niagara officials tell us that this KRW Press has really lived up to its reputation for speed, accuracy and versatility. They especially like two features of their KRW Press: the ease and accuracy with which the ram can be inched down to the work and the speed with which it converts from one set-up to another.

Let KRW help with your pressing problems. We make a full line of one, two and three cylinder Hydraulic Presses; 25-150 ton capacities; hand, air or motor-driven. Check with your Machinery dealer or write us for literature and prices.



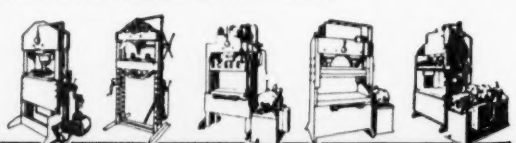
KRW 37F, 75 Ton Motor Driven Hydraulic Press with special wide bed used at Niagara Blower Co. for straightening and bending operations in the manufacture of Heat Exchangers. Press is shown straightening an aluminum header.

ONLY KRW GIVES YOU ALL THESE FEATURES:

- **Heavy Construction Throughout.** Bed and Crown Members Truss Reinforced for Added Stiffness and Strength. A KRW Exclusive Feature.
- **Any Tonnage Pressure** up to Rated Capacity can be Obtained Quickly and Selected Pressure Locked for Repetitive Operations.
- **One Swinging Ball Arm** Controls Motion of Ram Downward, Holds Pressure on Work, or Returns Ram.
- **Excellent "Inching" of Ram** Because Motor Runs Only When Operator Moves Ball Arm for Downward Ram Travel.
- **Spring Return of Ram** Gives Maximum Speed on Up-Stroke.
- **Highest Quality** Radial Type Hydraulic Pump.
- **Direct Connected Motor Drive** Through Flexible Coupling.
- **Two Speed Hand Pump** also Furnished on Motor Driven Presses in this series.

K·R·WILSON

213 Main Street, Buffalo 3, N. Y



Designers and Builders of the Right Hydraulic Press to Solve Your Metal-working Problems!

For more information on products advertised, use Inquiry Card, page 247

NEW Ettco-Emrick TAPPING ATTACHMENTS

NOW . . . BETTER THAN EVER!

These NEW Ettco-Emrick Tappers give you advantages never before thought possible in tapping attachments! Extra long life . . . unusually delicate sensitivity . . . close tolerance accuracy . . . and considerably higher tapping speeds.

It's all due to a combination of startling NEW patented improvements and time-tested features. Consider what they offer . . .

- A selection of sizes to cover a tapping range from No. 0 to ¾"
- A new super-sensitive friction clutch which provides a more powerful drive and longer life.
- A highly efficient patented cooling system . . . in the small and medium tappers, a pumped oil bath . . . in the large tappers, a fan cooled system.
- Strong, durable, attractively finished housings.
- Newly designed, true-running "balanced" tap chucks.

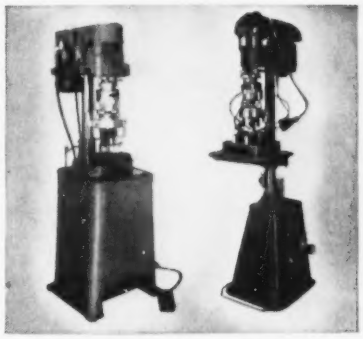
WRITE FOR BULLETIN 22A
for full details on sizes, capacities and prices.

ETTCO TOOL CO., INC.
592 Johnson Ave., Brooklyn 37, N. Y.

SEE YOUR LOCAL
Ettco-Emrick
DISTRIBUTOR
He's been carefully selected for his technical know-how, his integrity and financial soundness. As a local businessman who depends on your support, he has a personal interest in providing a satisfactory answer to your problems and in giving you fast, efficient service.

DRILLING and TAPPING EQUIPMENT NEWS

Tapping Machines Boost Multiple Head Output



Ettco-Emrick tapping machines are designed for automatic or semi-automatic operation with multiple spindle drilling or tapping heads and single spindle tapping attachments. The No. 72A machine is foot or air-operated. The No. 74 machine is air operated and electrically controlled. *Details in Bulletins No. 72A and No. 74. Write Ettco Tool Co., 592 Johnson Avenue, Brooklyn 37, N. Y.*

Electric Indexing Fixture Has Fast, Precise Action

Ettco-Emrick Indexing Fixtures provide smooth, shockless, positive action. Can be used on any machine base. Synchronization of index fixture with outside machine member is electrically controlled. Utilizes interchangeable nesting plates ranging from 10" to 14" in diameter. *Details in Bulletin No. 97. Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn 37, N. Y.*

Balanced Tap Chuck Insures Greater Accuracy

Balanced construction of this newly designed precision-made Ettco-Emrick tap chuck eliminates "whipping" action and insures greater accuracy. Light weight and small external dimensions minimize spindle inertia on reversing, making it suitable for either light, sensitive work or heavy duty jobs. Only three sizes needed to cover the complete range of tap capacities from No. 0 to 1". *For details, write Ettco Tool Co., Inc. 592 Johnson Ave., Brooklyn 37, N. Y.*

Orchard Spraying, Berks County, Pennsylvania — Shostal Press Agency Photo

BULLARD

The Invisible Background of Industrial Progress

Modern farming methods, like modern industrial methods, use modern equipment to do the job better and faster. From the ox plow of our forefathers to the tractor with plow attachments, from the scythe to the modern reaper, from the hand hoe to the mechanized cultivator — these are just a few examples of the progress made in the farm equipment field which makes possible greater crops per acre with far less effort and time.

Modern Machine Tools are basic tools in the manufacture of mechanized farm equipment including tractors, sprayers, spreaders, cultivators and reapers — all truly, "The Invisible Background of Industrial Progress."

THE BULLARD COMPANY • BRIDGEPORT 2, CONNECTICUT

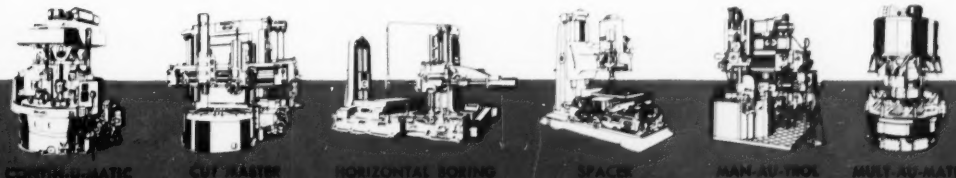
Bullard Horizontal Boring, Milling and Drilling Machine

Available in two sizes, 4" and 5" spindles with optional capacities

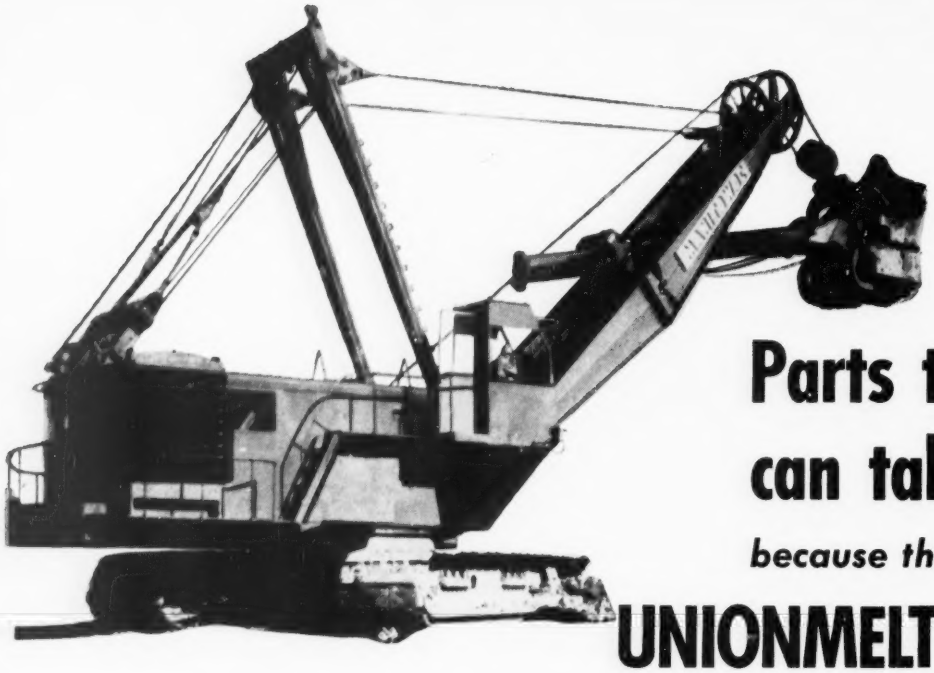
Can close machining tolerances be maintained on large, bulky pieces? Of course — if you use a Bullard Horizontal Boring, Milling and Drilling Machine.

Here is a typical application experienced by Combustion Engineering, Inc. of Chattanooga, Tennessee, manufacturers of high-pressure boilers. The total length of the piece to be machined is 11 feet 4-13/32 inches and the job consists of boring fifteen 4-inch holes in a row and then milling the ends. This was accomplished in four operations per hole, holding each hole within a tolerance of +.001"–.000. Total machining time — eight hours per piece.

If you are looking for a versatile, rugged, horizontal boring, milling and drilling machine with "built-in" accuracy and efficiency, investigate Bullard. Your Bullard Representative will explain its many features or, write to The Bullard Company, Bridgeport 2, Connecticut — phone 6-2511.



BULLARD



Parts that can take it...

because they're UNIONMELT Welded

Dipper sticks have to be strong to absorb severe stresses. That's one reason why the three main sections of this part are UNIONMELT *welded. Sound welds can be made in metal up to 3-in. thick in a single pass.*

A power shovel dipper stick has to be strong. It must withstand severe banging, twisting, and bending stresses as its huge scoop bites out hundreds of tons of earth and rock in each day's operation. But these dipper sticks can take it—they're made by UNIONMELT welding.

Strong, clean UNIONMELT welds can be made in metals up to 3-in. thick in a single pass. There is no limit to the metal thickness that can be joined by multiple passes.

Research and years of experience have helped LINDE to develop a top notch team of fabricating processes—HELIARC, sigma, and UNIONMELT welding. For small shops or huge production lines, from carbon steel to complex alloys—there is a LINDE electric welding process to do the job. Your local LINDE representative will help you determine the best welding process for your job. Call him today for more information.

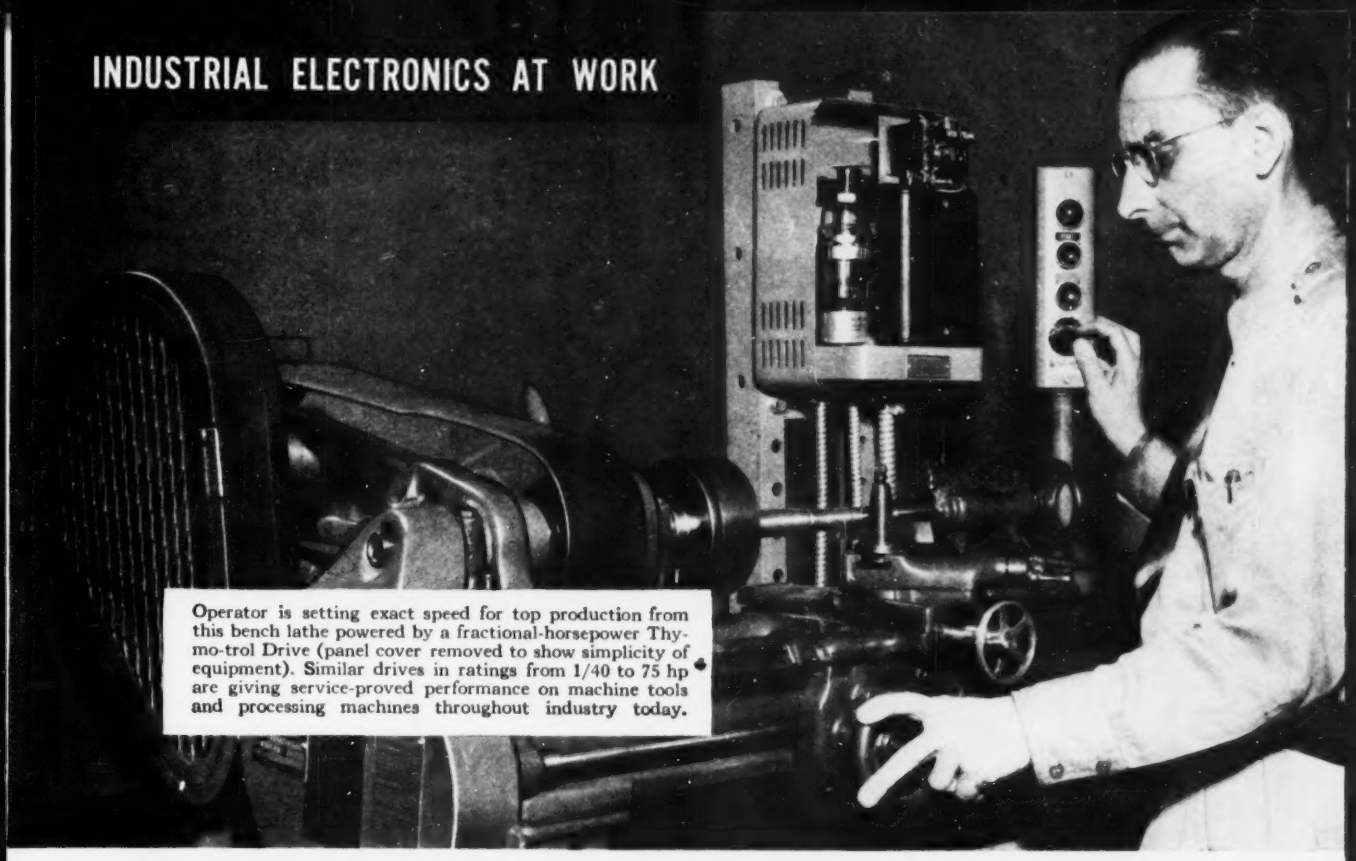
LINDE AIR PRODUCTS COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Other Principal Cities
In Canada: DOMINION OXYGEN COMPANY
Division of Union Carbide Canada Limited, Toronto

Linde Trade-Mark

"Heliarc," "Unionmelt," and "Linde" are registered trade-marks of Union Carbide and Carbon Corporation.

For more information on products advertised, use Inquiry Card, page 247

INDUSTRIAL ELECTRONICS AT WORK



Operator is setting exact speed for top production from this bench lathe powered by a fractional-horsepower Thy-mo-trol Drive (panel cover removed to show simplicity of equipment). Similar drives in ratings from 1/40 to 75 hp are giving service-proved performance on machine tools and processing machines throughout industry today.

When close speed regulation is required . . .

General Electric THY-MO-TROL* Drives Can Help You Cut Production Costs

EXACTLY THE RIGHT SPEED FOR TOP PRODUCTION is assured by the *wider speed ranges* offered by G-E Thy-mo-trol Drives . . . your machines are more versatile and more productive for a greater variety of jobs. Typical Thy-mo-trol Drive speed ranges are 5:1, 20:1, 50:1 and 100:1; and, if required, much higher speed ranges are possible under certain conditions.

IMPROVED PRODUCT QUALITY AND LESS SPOILAGE are made possible by the *infinite number of speed steps* and *closer speed regulation* provided by G-E Thy-mo-trol Drives. You get and hold the exact speed required for every job and maintain proper speed throughout your entire operating cycle.

GREATER PROTECTION FOR DRIVE AND MACHINE is yours with all full-wave G-E Thy-mo-trol Drives because current limiting features eliminate the danger of overloading machine or drive. If the driven machine should jam, the motor will automatically stall before torque becomes excessive.

*Reg. Trademark of the General Electric Co.

FOR COMPLETE INFORMATION on these and the many other features of G-E Thy-mo-trol Drives contact your nearest G-E Apparatus Sales Office or send in the coupon shown below.

General Electric Company, Section D790-1
Schenectady 5, New York

- ☐ GEA5337, Thy-mo-trol Adjustable-speed Drives. Up to 30 hp.
- ☐ GEA5827, Precision Controlled Thy-mo-trol Drive. ¾ to 10 hp.
- ☐ GEA5829, Simplified Thy-mo-trol Drive. ¾ to 3 hp.
- ☐ GEA5179, Half-wave Thy-mo-trol Drive. Up to ½ hp.
- ☐ GEC-703, Full-wave Thy-mo-trol Drive. ¼ to ½ hp.

Please send me the bulletins checked

- ☐ for reference only
- ☐ for planning an immediate project

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

GENERAL ELECTRIC

150 SQ. IN. OF WORK SURFACE

ABRASIVE NO. 1½ TOOLROOM SURFACE GRINDER—a quality-built hand feed grinder—has the capacity your toolmakers need for their work—nearly 50% more than most small surface grinders. Abrasive No. 1½ is easy to work with—it's a big favorite with toolmakers throughout the world. Thousands of these simple, efficient grinders are in service today—in tool and die shops, and in the tool departments of production plants. Send for Catalog giving complete details. Abrasive Machine Tool Company, 12 Dunellen Road, East Providence 14, R. I.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

Abrasive Quality is Reflected in the Finish of Your Product

For more information on products advertised, use Inquiry Card, page 247

8 out of 10 machine tool users want Centralized Lubricating Systems

Studies in Centralized Lubrication No. 153

83% of the executives questioned in a recently published survey of 14,334 metalworking plants demand centralized lubrication of machine tools. 37% prefer hand-operated systems; 58% said they want fully automatic lubrication. Farval offers both types of centralized systems that these machine tool users know, use and prefer.

Farval pays big dividends

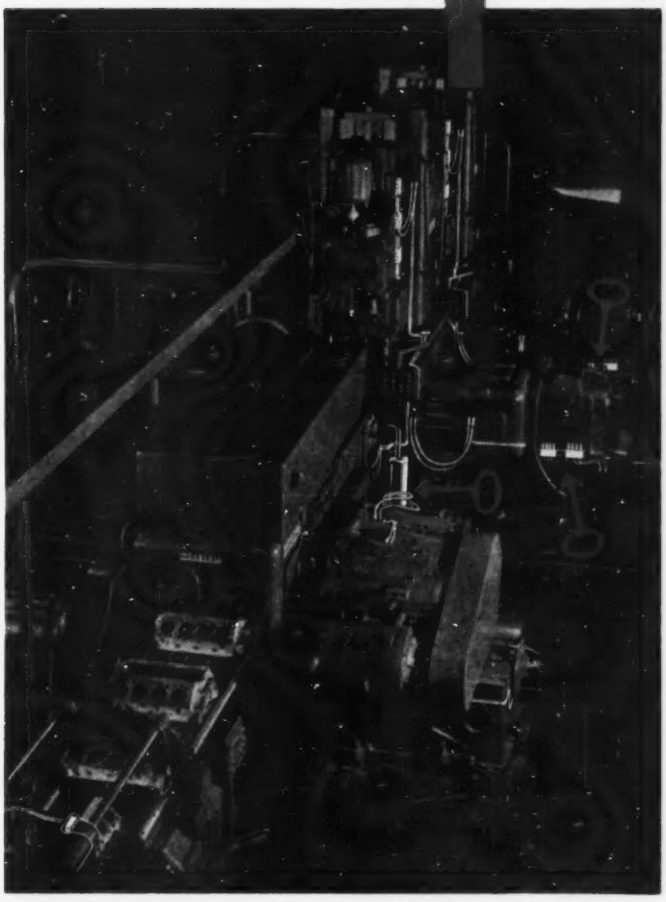
Farval Centralized Lubrication of industrial equipment has been saving money, man hours and operating expense for more than 25 years . . . "Spent $900 for Farval, saved $4,420" . . . "$7,500 invested in Farval earned us $389,640" . . . "Farval saved us $537,591 in 15 years" . . . Such reports are typical of the thousands given us by executives who have long since discovered that small investments in Farval save thousands of dollars in maintenance, production time and lubrication expense.

FARVAL is the Dualine system of centralized lubrication that hydraulically delivers oil or grease, exactly measured, to each individual bearing as often as desired.

Free Lubrication Survey

Why not let us send one of our lubrication engineers to inspect your plant equipment? Without obligation, he will present a written analysis of what Farval can do for you. Write also for Bulletin 26 for the complete Farval story. The Farval Corporation, 3276 East 80th St., Cleveland 4, Ohio.

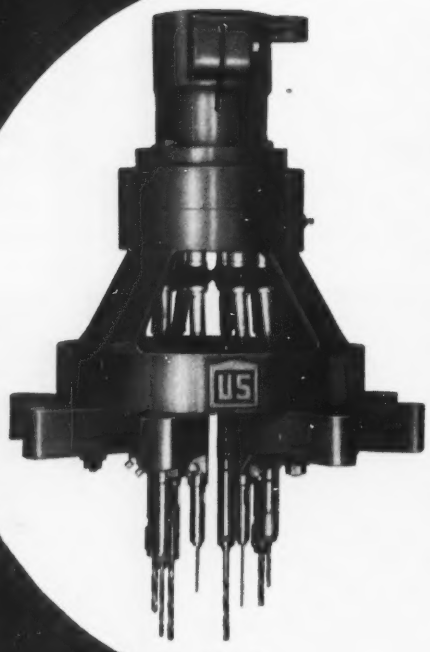
Farval is an affiliate of The Cleveland Worm & Gear Co. Represented in Canada by Peacock Brothers, Limited.



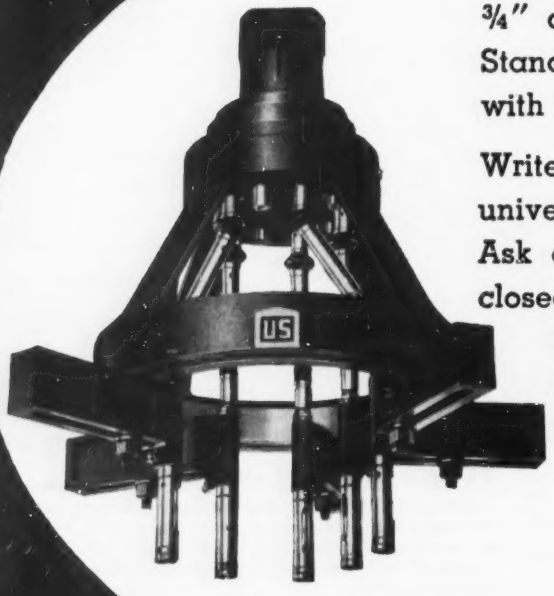
KEYS TO ADEQUATE LUBRICATION—Wherever you see the sign of Farval—the familiar valve manifolds, dual lubricant lines and central pumping station—you know a machine is being properly lubricated. Farval manually operated and automatic systems protect millions of industrial bearings.

Photo shows a Farval-equipped Ingersoll cylinder block process line in a well-known automobile manufacturing plant—typical of *Farvalized* machine tools throughout the country. Courtesy of The Ingersoll Milling Machine Co.

KEEPING UP WITH THE JONESES



U-1



U-2

The "Joneses" and the companies they own save money, time and effort by relying on "US" Adjustable Multiple Spindle Drill Heads with *QUICK-CHANGE* universal joint assemblies.

We give the "Joneses" and you —immediate delivery.

The U-1 Head—two to eight spindles—can be adjusted to a minimum distance between spindles of 11/16" anywhere in an area of a 6" diameter circle.

The U-2 Head has two to twelve spindles, each built to drill up to ¾" diameter hole in cast iron. Standard spindles are furnished with No. 1 or 2 Morse Taper.

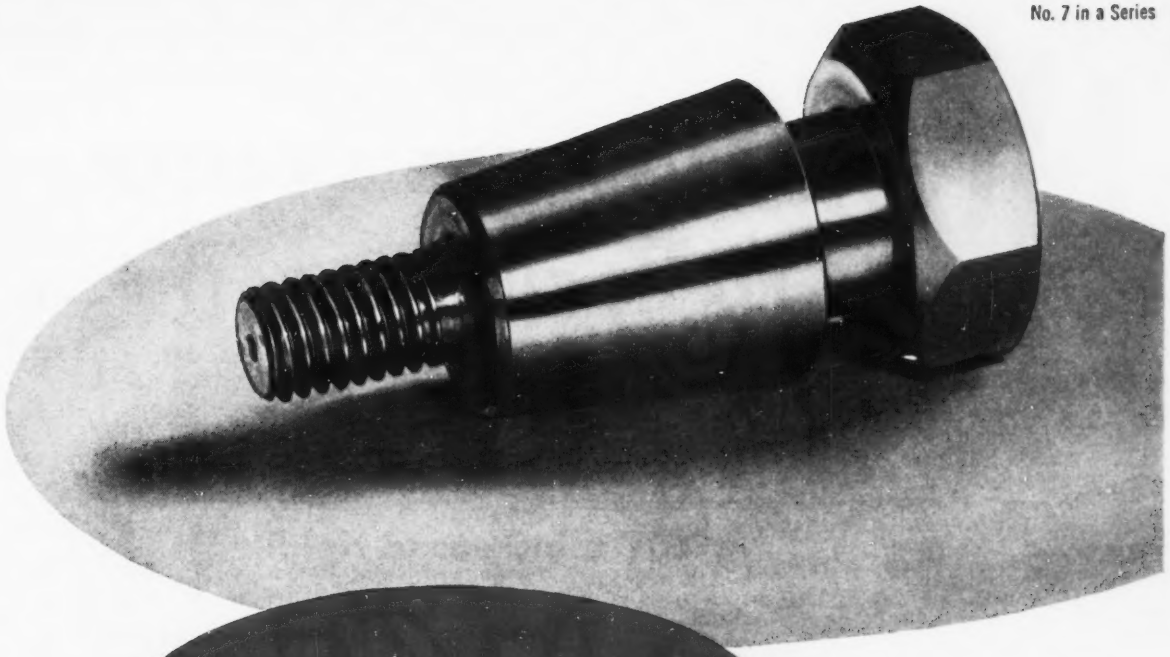
Write for details on any type of universal joint adjustable head. Ask also about our totally enclosed gear driven adjustable, fixed center, or individual lead screw tapping heads.

US HEADS SINCE 1915

UNITED STATES DRILL HEAD CO.
616-618 Burns St., Cincinnati 4, Ohio

For more information on products advertised, use Inquiry Card, page 247

No. 7 in a Series



carbide service available

data for comparison

Part	Petcock Center
Machine	1⅝" Six Conomatic
Tools	100% Carbide Tipped
Material	X-1112
Stock Size	1" Hexagon
R. P. M.	1562
Time	8 seconds

Where conditions are favorable, 100% carbide tool-ups on "Automatics" make HSS tools appear as obsolete as ancient tools of carbon steel.

In determining the "favorable" conditions, the Conomatic Carbide Development is of real service to the "Automatic" user. Without risk of production loss or obligation of machine purchase, he gets an eye-witness demonstration of the profit possibilities of 100% carbide tooling to his own work.

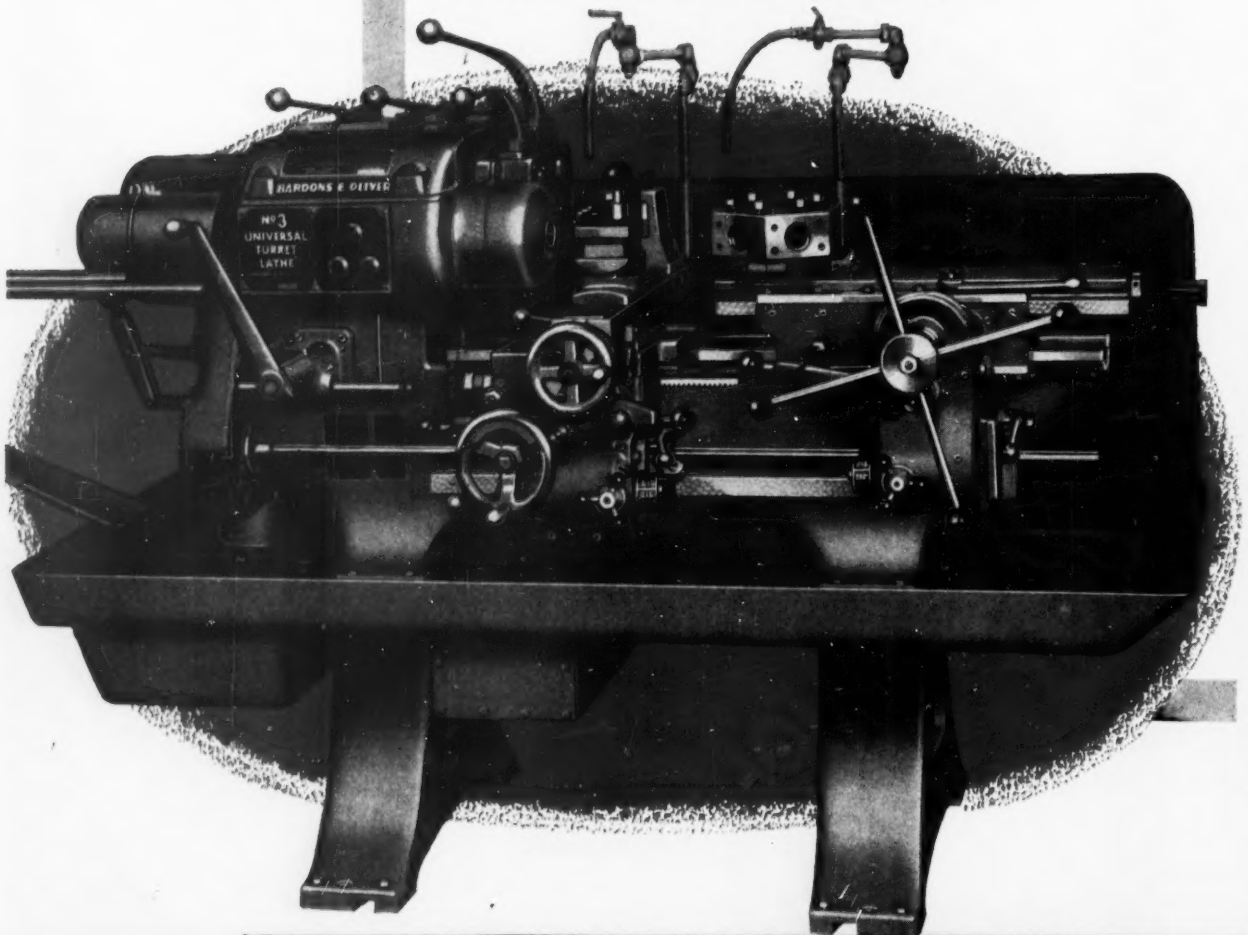
Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

New... BARDONS & OLIVER No. 3 TURRET LATHE...

★ 25% higher speed

★ 50% more power

★ 100% increased rigidity



BARDONS & OLIVER, INC.

1135 WEST 9TH STREET · CLEVELAND 13, OHIO

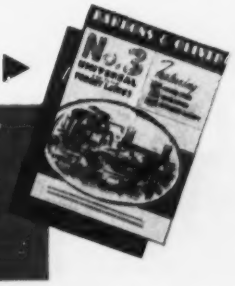
Featuring!

- √ 1825 R. P. M. Spindle Speed
- √ Unequaled Rigidity of "X" Type Cross Ribbing over Full Length of Bed
- √ 100% Anti-Friction Bearing Headstock
- √ Single Lever Feed Selectors for both the Hex Turret and Universal Carriage
- √ Alloy Bronze Anti-Backlash Nut on Cross Slide Screw
- √ "One-Shot" Lubrication of all Tool Slide Ways
- √ Flange Type Motor Mounting that Eliminates all Belts and Pulleys
- √ Hardened and Ground Steel Turret Slide and Saddle Ways, Gibs and Caps
- √ 7½ H. P. available at each one of 12 Geared Spindle Speeds
- √ Instantaneous High-Low Speed Change through Double Multi-Disc Clutch
- √ Replaceable Bed Ways of Solid Hardened and Ground Alloy Steel
- √ Large Hardened and Ground-in Thread Ball Bearing Cross Slide Screw
- √ Sealed Carriage and Saddle Aprons
- √ Improved Square Turret, Designed and Built for Lifetime Accuracy
- √ Impeller Type Coolant Pump with Individual Motor Drive
- √ Optional Collet Chuck Capacities (1½" or 2")

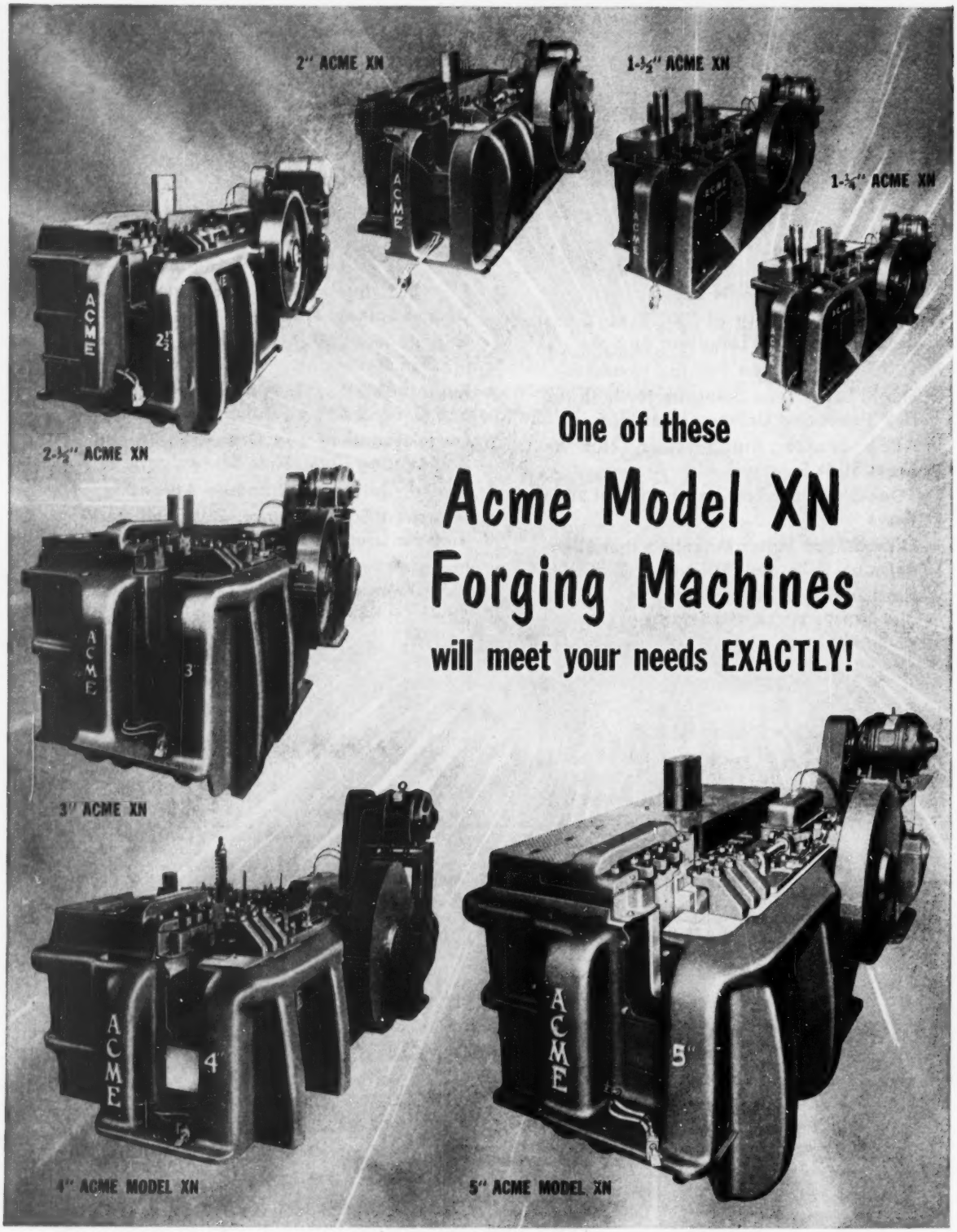
Specifications!

Swing Over Bed	15½ inches
Swing Over Guides	13¾ inches
Swing Over Cross Slide	7⅝ inches
Collet Chuck Capacity	1½ or 2 inch round
Hexagon Turret Travel	10 inches
Cross Slide Travel	9 inches
Carriage Longitudinal Travel	18½ inches
Turret and Carriage Power Feeds with Single Lever	6
Number of Speeds with Single Speed Motor	12
Motor Horse Power	7½
Net Weight With Cabinet Motor	3050 pounds
Net Weight With Flange Motor	2850 pounds

SEND FOR NEW NO. 3 CATALOG ▶



MANUFACTURERS OF A COMPLETE LINE OF
TURRET LATHES AND CUTTING OFF LATHES



One of these

Acme Model XN Forging Machines

will meet your needs EXACTLY!

THE HILL ACME COMPANY

ACME MACHINERY DIVISION • 1203 W. 65th St., Cleveland 2, Ohio
ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES
HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

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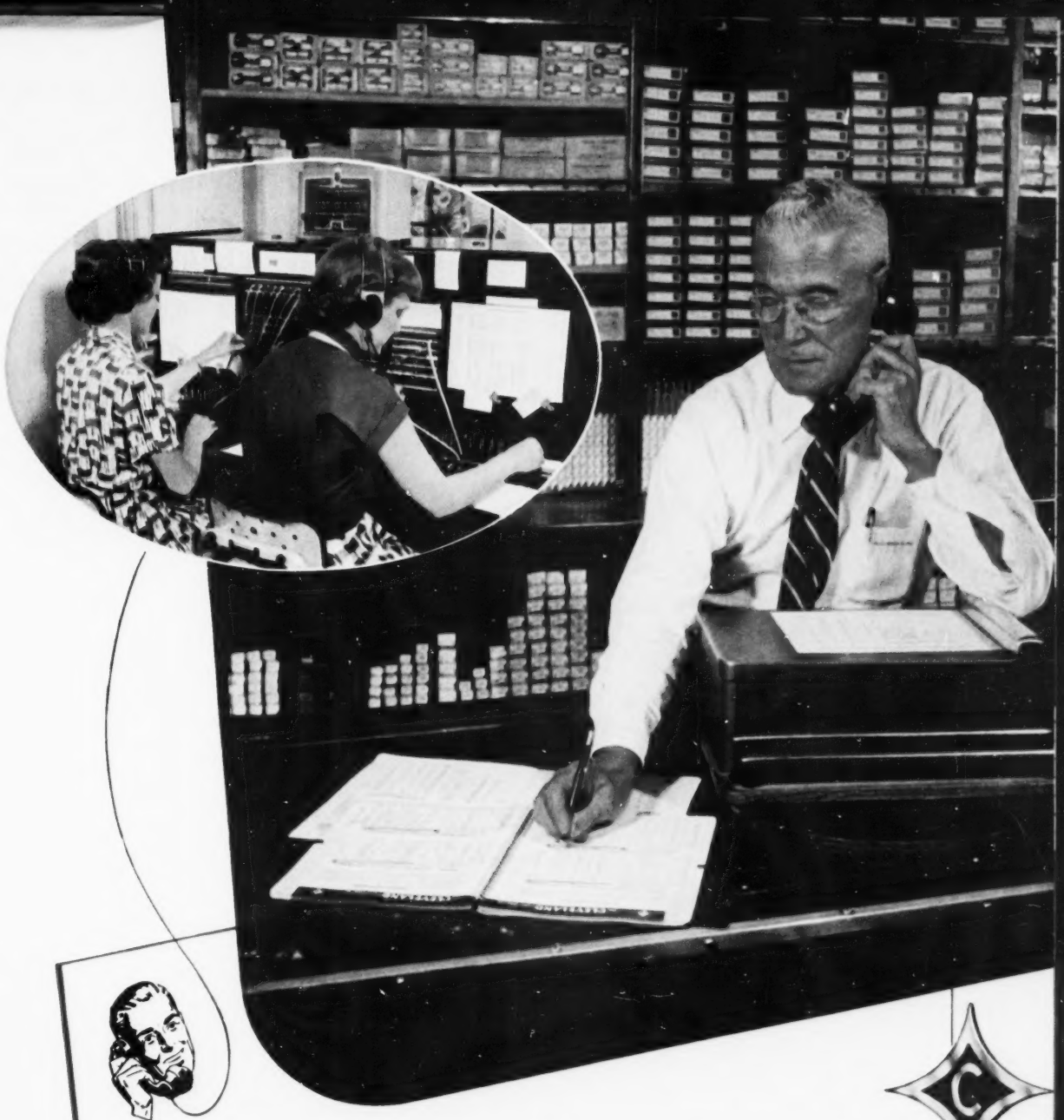
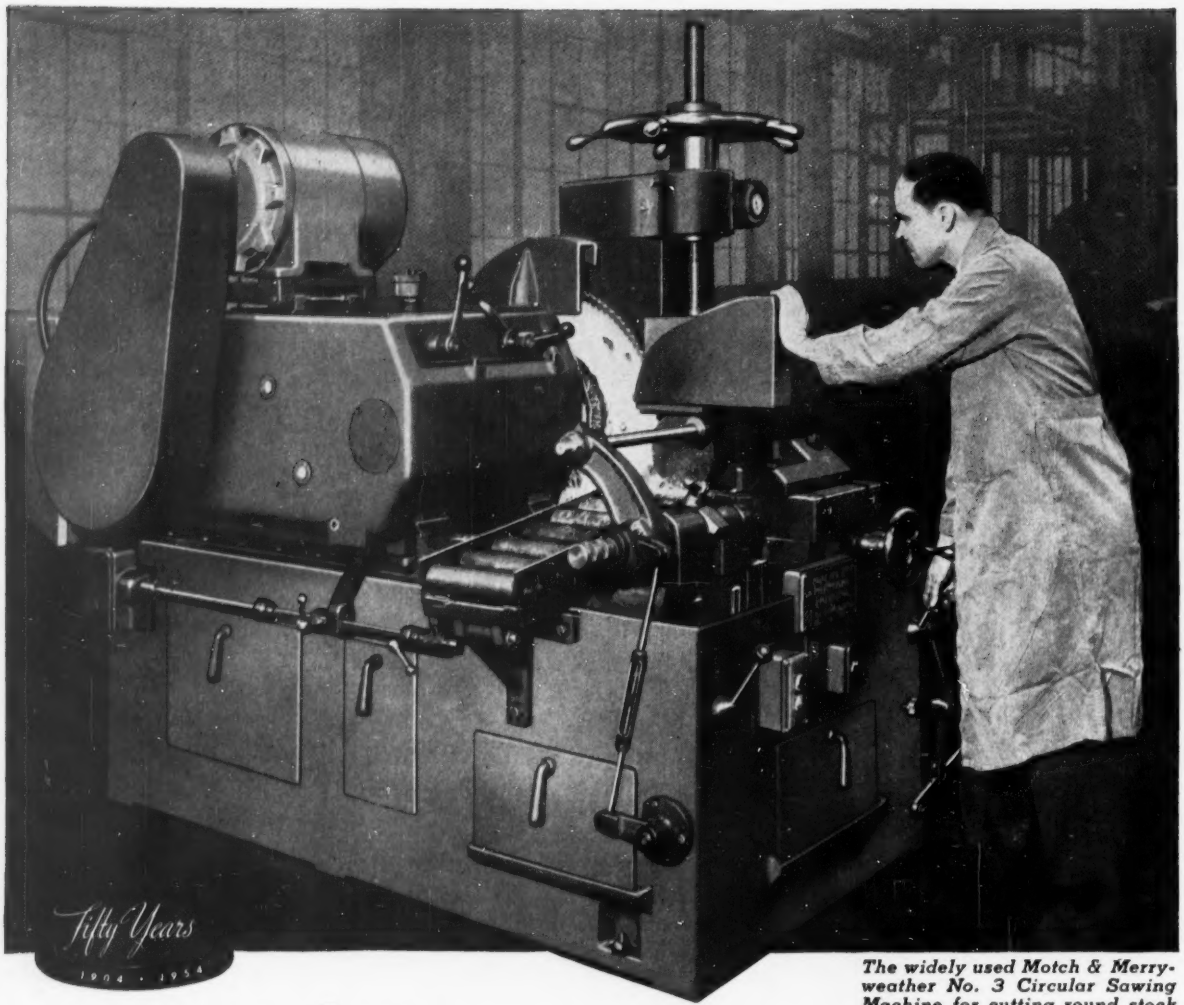


TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

SAVE TIME by getting what you need in a hurry
SAVE MONEY by cutting down your inventories
SAVE BOOKKEEPING by purchasing from one source

THE CLEVELAND TWIST DRILL CO.
1242 East 49th Street • Cleveland 14, Ohio
Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58
E. P. Barrus, Ltd., London W. 3, England



The widely used Motch & Merryweather No. 3 Circular Sawing Machine for cutting round stock up to 10" diameter.

remember...

It's the Cost per Cut that Counts!

SECURE HIGH PRODUCTION AT LOW COST

For every ferrous or non-ferrous metal, for any shape or size, for production or short runs, – study *new high* records made by Motch & Merryweather Circular Sawing Machines employing the Triple-Chip Method and available in:

A complete size range for cutting stock up to 43" diameter.

THE MOTCH & MERRYWEATHER MACHINERY CO.

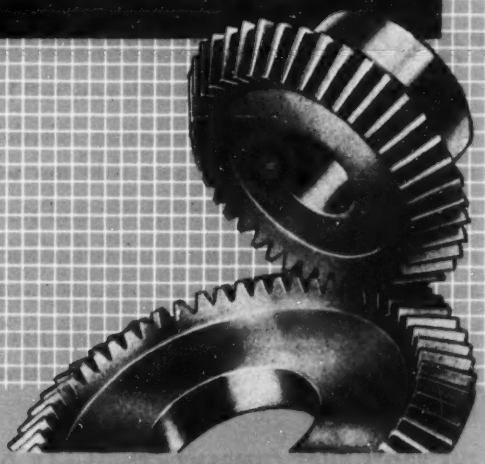
CLEVELAND 13, OHIO

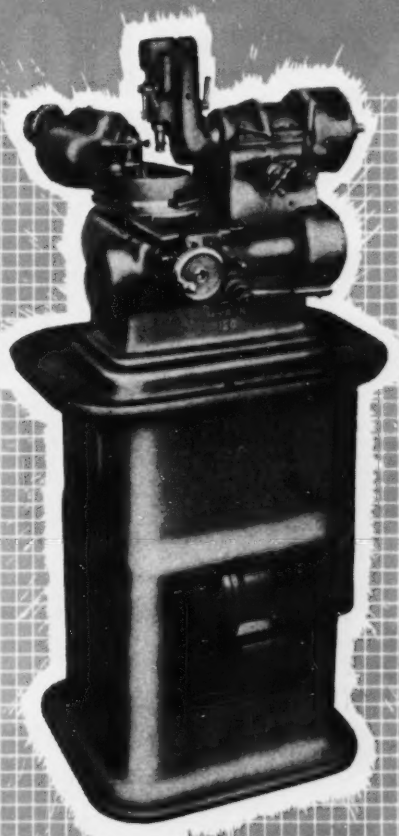
Builders also of Production Milling, Vertical Turning, Automatic and Special Machines

For more information on products advertised, use Inquiry Card, page 247

THE ULTIMATE IN

BEVEL GEAR ACCURACY





- low-cost tooling
- simplicity of set-up

NO. 120 MIKRON

fine pitch

BEVEL GEAR HOBBING MACHINE

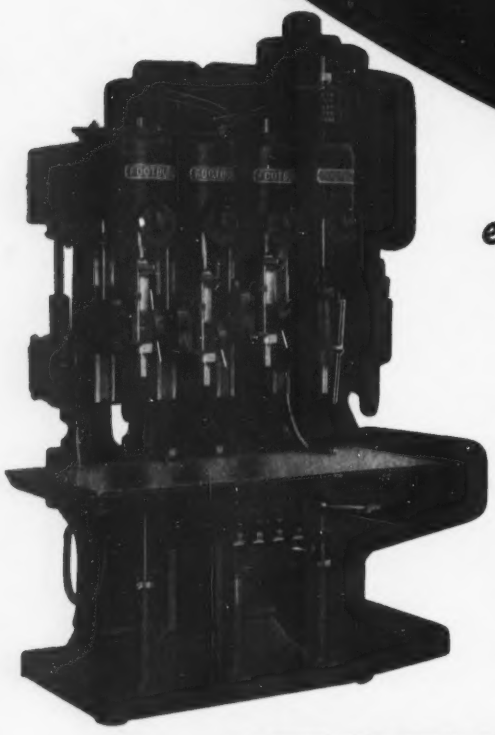
RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

FOOTBURT

faster...

for tool room or assembly line



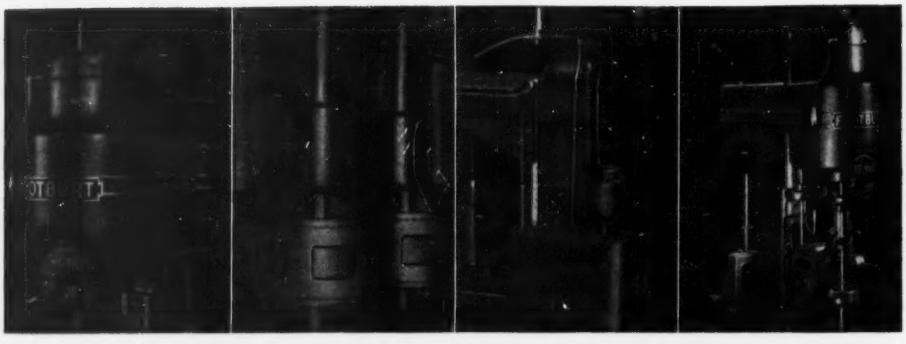
engineered for production

The choice of fine machine tools now will help you meet those new production schedules. Footburt Sensatives are built with the wide range of speeds and with power and sturdiness to drive cutting tools to their full capacity. They are built with the care and precision that will keep them accurate over a long period. Write, wire or phone for prices and delivery information.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

Detroit Office: General Motors Building

No. 2 Machine with Back Gear • 12" Overhang • ⅝" Drilling Capacity in Steel • Optional Speed Ranges • 185 to 2300 RPM • 280 to 3450 RPM • Vertical Motor Drive with Standard Single Speed Motor • Power Feed Assembly • Tapping Attachment • Coolant Outfit.



☆engineered for production

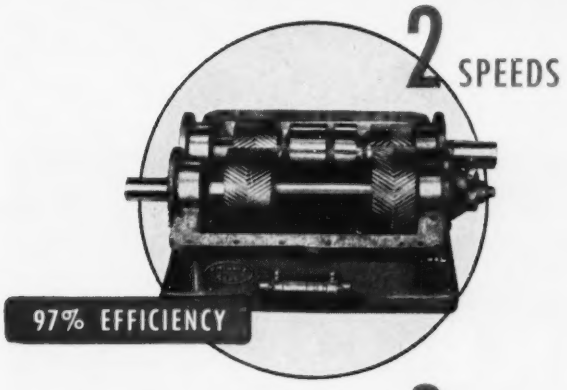
FOOTBURT

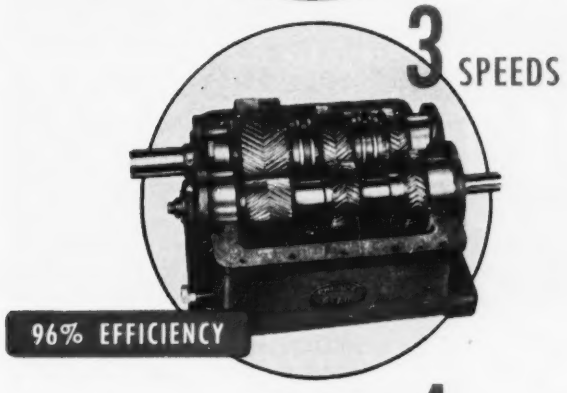
MACHINE TOOLS

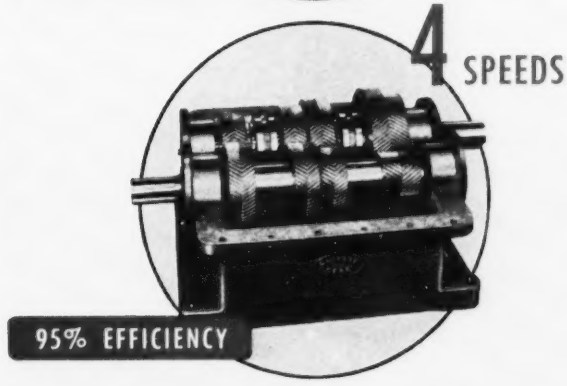
For more information on products advertised, use Inquiry Card, page 247

a "standardized" line

GEARED, SELECTIVE TYPE CHANGE SPEED UNITS







Yes, "another first" with *Phillie Gear*, these *standardized*, self-contained, compact *all-gear type speed changers*. They are available in 2, 3 or 4 speed changes, providing definite ratios of speed reduction, speed increasing (or a combination of both). Speed changes are accomplished by just the "mere turn of a control lever".

These exclusive units were designed to fill Industry's need for a highly efficient, precision-built *standardized line* . . . to eliminate the high cost and delayed deliveries of specially designed units.

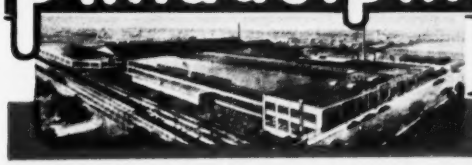
Gear specifications: All gears and pinions are Sykes Continuous Tooth Herringbone type, precision cut of involute shape, carefully heat treated and finished, and designed for maximum tooth contact and overlap.

All component parts and materials in these unusual Units are of highest quality and workmanship: Housings, Shafts, Bearings, Clutches, Lubrication Systems, etc.

Ratings are according to AGMA recommendations for continuous service, with allowance for 100% overload in starting and for momentary shock loads . . . shafts and bearings are of proper size to permit heavy overhung loads resulting from use of sprockets or pulleys.

Be convinced, write for 24 page illustrated catalog #CSU-52.

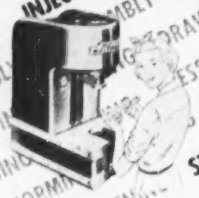
Philadelphia Gear Works, INC.



ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls



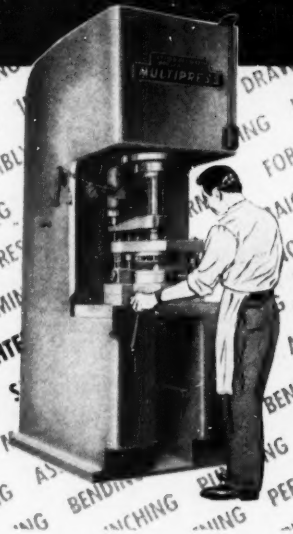
If your production involves
any of these operations

MAKE SURE

you know why *it pays* to do it with

MULTIPRESS®

the multi-purpose tool for cutting production costs



DENISON Hydr-Oil-ics

PUMPS | MOTORS | CONTROLS | PRESSES

MULTIPRESS offers a wide range of sizes in both bench-type and floor models. Capacities range from one ton to 75 tons—and their efficient hydraulic power handles operations normally requiring an even wider range of pressures. An extensive choice of manual and automatic controls—plus interlocking automatic feeds, indexing tables and other accessories—make Multipress one of the most versatile production tools available to industry. Write today for your copy of the bulletin "MULTIPRESS—and how YOU can use it."

THE DENISON ENGINEERING CO., 1152 Dublin Rd., COLUMBUS 16, OHIO

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2 New GLEASON TESTERS

For COMPLETE CHECKING ✓ of Small Gears

NO. 104 SPUR GEAR TESTER

for spur, helical, and internal gears up to 4½" center distance.

✓ *A ROLLING TEST for composite error, recorded in chart forms.*

✓ *A RUNNING TEST under actual operating speeds and loads.*

For complete inspection of all small gears, use both types of test. The recorded rolling test shows an exact measurement of total error, including profile, spacing, and eccentricity effects. The power running test shows how the gears perform under actual operating conditions, and permits visual inspection of tooth contact pattern.

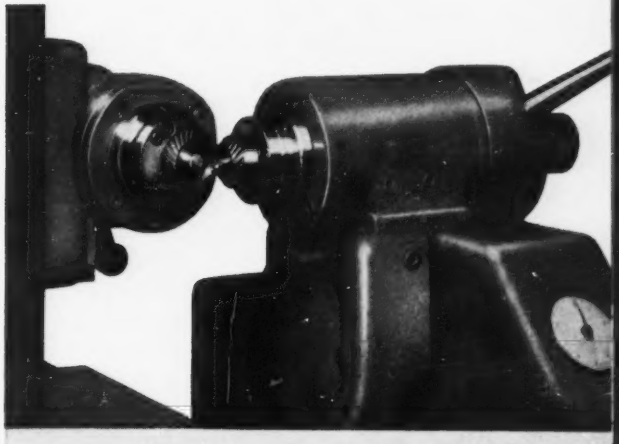
Note these provisions for making both types of check *on the same tester:*

For the RECORDING TEST

- 1/50 HP drive at 7.2 RPM
- Pressure between gears adjustable by 4 oz. increments, up to 5 lbs.
- Detachable electronic recorder with 5-stage variable magnification

For the RUNNING TEST

- ¼ HP drive
- Drive spindle speeds up to 14,000 RPM
- Precise load control by electric braking



NO. 104 ANGULAR HYPOID TESTER

for bevel and hypoid gears up to 4¼" diameter.

***WRITE FOR FULL INFORMATION** on how these new testers will improve your small gear inspection.*

GLEASON WORKS

BUILDERS OF BEVEL GEAR MACHINERY FOR OVER 85 YEARS

1000 UNIVERSITY AVE. · ROCHESTER 3, NEW YORK

GLEASON

OSBORN

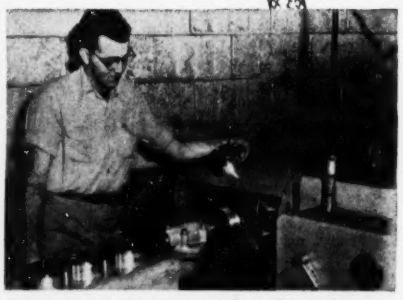
See how you get better quality at lower cost!

THESE magnified, unretouched photos show the comparison of gear teeth surfaces when burrs are removed by hand and when burr removal *and blending* is done by the Osborn *Brushamatic.** The blended surface junctures have no scratches to concentrate stresses. Their uniformity and smoothness mean superior performance and greater life expectancy.

You not only get *greater quality* when you remove burrs and blend with the *Brushamatic*... This push-button method *boosts output* per manhour as much as 5 to 10 times. Scrap loss is nil. It saves floor space and it is neat and clean.

The **O**sborn **B**rushing **A**nalyst will gladly help you find out how you can improve your products and cut costs with this new technique. Call your **OBA** today or write *The Osborn Manufacturing Company, Dept. D-17, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

INFORMATION: *Write today for your copies of Booklets on Automatic Deburring and on Brushamatic Machines.*



20 times as fast. *Here, the Osborn Brushamatic removes burrs and blends counter balance bearings for aircraft engine. With former method, output was 6 parts per hour. Present Brushamatic rate is 120 parts per hour. Results are perfectly uniform . . . piece after piece.*

*Trade-Mark

Osborn Brushamatic

BETTER QUALITY . . . LOWER COSTS . . . AT THE PUSH OF A BUTTON

For more information on products advertised, use Inquiry Card, page 247

Note:

...cent cash ...ymen made on Sept. 4, 1953.

...will be ... to holders of record of March 1.

or $4.30 a share, comp... ... $10,511,423, or $6.95 a share, in

Angell Completes Major Pressroom Modernization with 16 New Presses... All Bliss-Built!

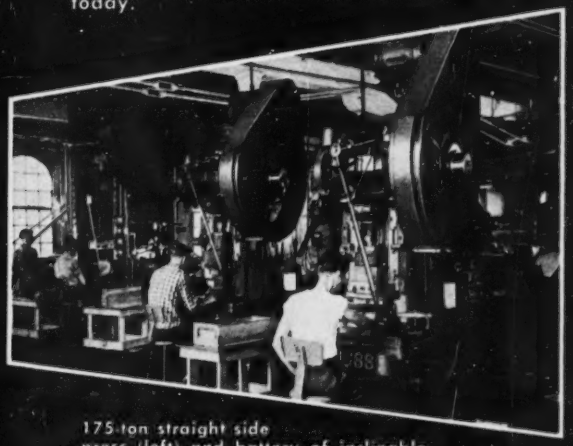
DAYTON, Ohio—New stamping capacity will put Angell Manufacturing Company in the "best competitive position in its history", R. H. Walker, company president, said today. He explained that the addition of 16 new Bliss presses has increased the company's capacity by 50%. Angell manufactures embossed, etched and lithographed nameplates, dials and escutcheons.

Angell decided to place all their press business with Bliss after years of experience with several makes of stamping presses. According to Mr. Walker, the Bliss presses were selected for their dependable operation, ease of set-up and maintenance, and reliable clutch performance.

...c Falls 1.70 Points ...

THERE MUST BE A REASON why Bliss presses are the unanimous choice of so many large contract shops. Dependable equipment? That's for sure: industry *knows* when it buys Bliss it buys designs that have stood the test of years.

To learn how Bliss presses can fit into your modernization plans, call for a Bliss engineer today.



175-ton straight side press (left) and battery of inclinable presses (above) are typical of new Bliss equipment used in the manufacture of nameplates, escutcheons and television panels.

BLISS
SINCE 1857

on your press is more than a name... it's a *guarantee*

E. W. BLISS COMPANY, Canton, Ohio
PRESSES, ROLLING MILLS, SPECIAL MACHINERY

Subsidiary: The Die Supply Company, Cleveland, O. • E. W. Bliss (England) Ltd., Derby • E. W. Bliss Company (Pacific) Pressco

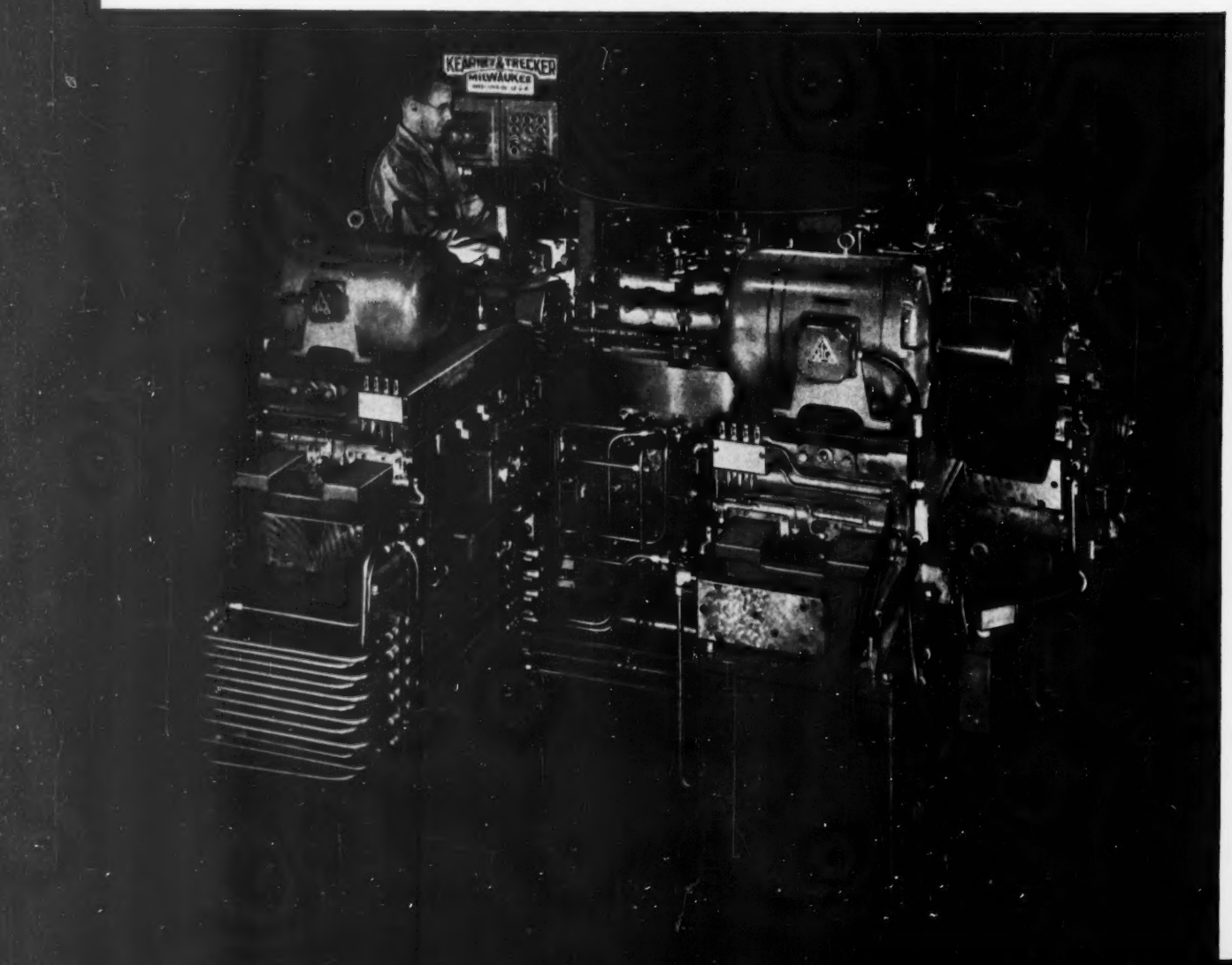
U. S. Plants in Canton, Salem and Toledo, Ohio; Hastings, Michigan; and San Jose, Calif. Branch Offices in Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, Toledo and Toronto, Canada. West Coast Representatives: Moore Machinery Co., Los Angeles and San Francisco; Star Machinery Company, Seattle. Other representatives throughout the world.

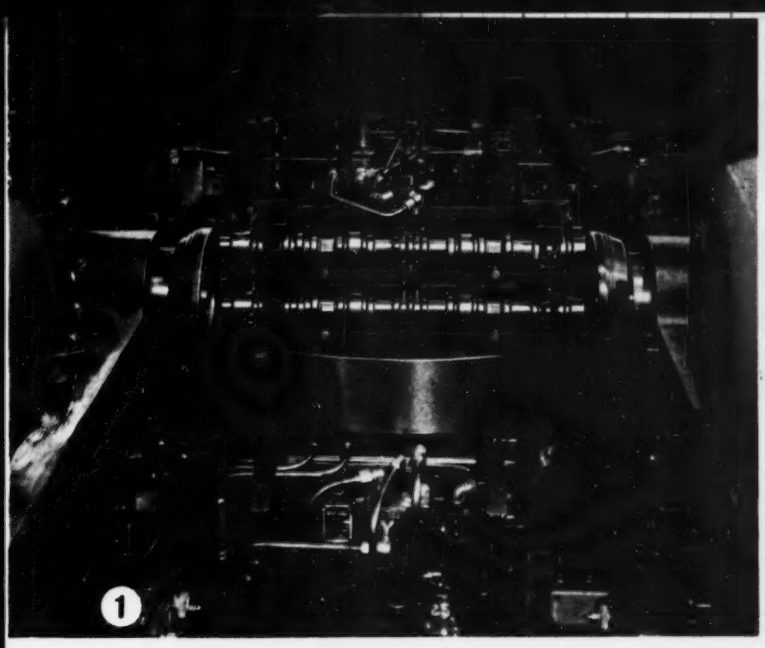
PRODUCTION MACHINING REPORT:

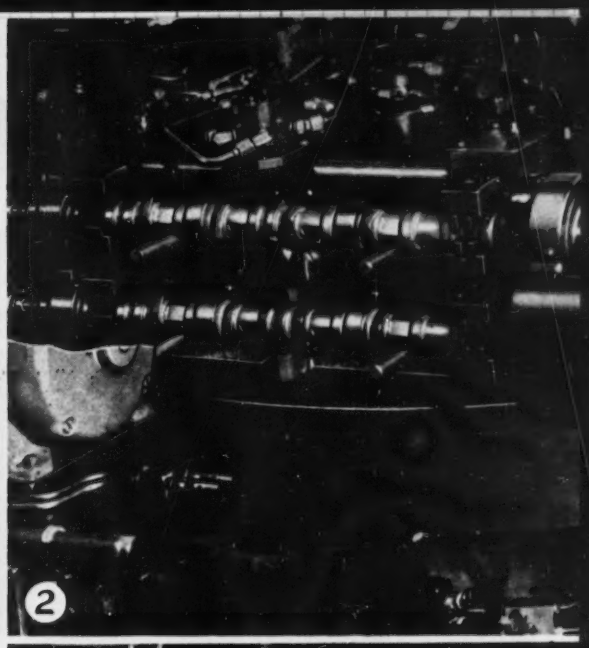
New production machine mills and drills 288 camshafts hourly

THREE of these high production, four-station rotary indexing machines were recently installed by one of the world's largest automotive manufacturers. A particularly interesting aspect of the machines — which were designed and built by Kearney & Trecker — is the fact that standard units were utilized wherever possible. This not only moved up the delivery date, but also resulted in a dramatic saving in cost. See photos 1, 2 and 3 for the sequence of operations which results in production of 288 cast iron camshafts per hour per machine.

Basically, the machine is comprised of a 60" rotary indexing table and base . . . two milling units, each with one spindle . . . one drilling unit with two spindles . . . and a second drilling unit with four spindles.





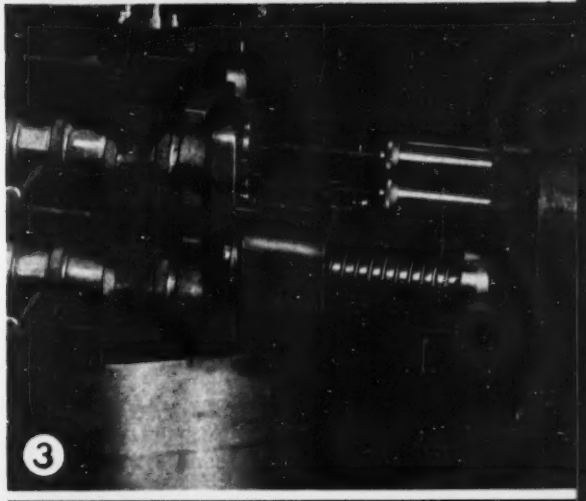


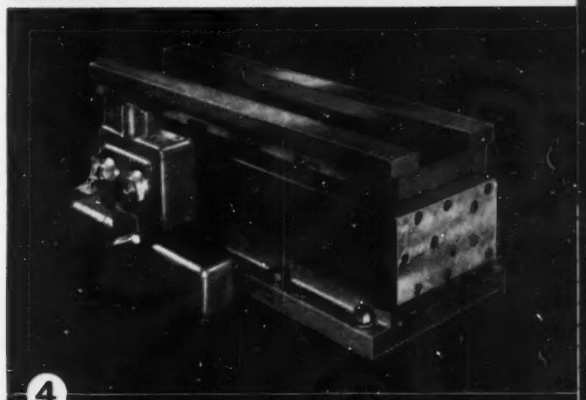
1. After 2 workpieces have been manually loaded, table indexes automatically to station 2, where both ends are milled to length. Each milling unit has a 10" dia. face mill with 36 T.C. inserted blades. Left hand head is powered by a 7½ hp motor. Right hand head by a 10 hp motor.

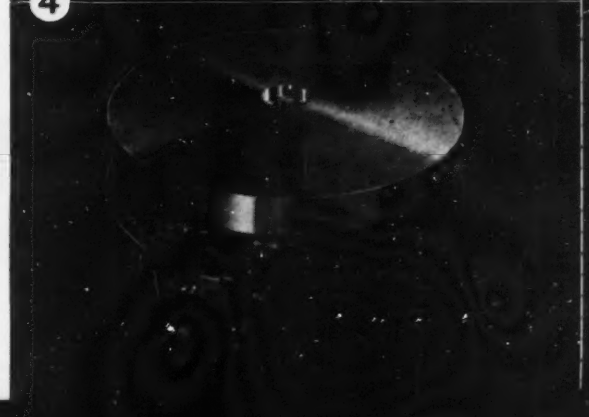
2. Table automatically indexes to drilling station and camshafts are center-drilled on each end. Drilling units are powered by a 1 hp motor. (Motor partially cut away to show drilling). Each of 4 hydraulic clamping and equalizing fixtures holds 2 workpieces. Location of workpiece is taken from end body diameters with end location from the center bearing.

3. At the final station there is a 2 hp drilling head which carries 4 spindles. Two drive holes are drilled in one end of each camshaft. Spindles operate at fixed speeds.

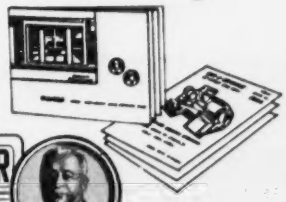
4. Here are two of the components which make major contributions to the machine's performance at reasonable cost. TOP: This is the feed slide unit. It is available in four standard sizes. All sizes feature a hydraulic control panel which can be mounted at either side... hardened and ground ways... a massive one-piece base casting which absorbs vibration. BOTTOM: This 60" rotary indexing table is one of four standard sizes available. Each table can be arranged for any practical number of indexes or for continuous rotary feed.







For more comprehensive facts on this machine and its standard units, write for Data Sheets No. 1018, No. 1019 and No. 1020. For details on the facilities and engineering services offered by our recently expanded Special Machinery Division, see your representative or write for booklet, "Doorway to a proven method for solving big or small metalworking problems." Kearney & Trecker Corp., 6784 West National Ave., Milwaukee 14, Wisconsin.

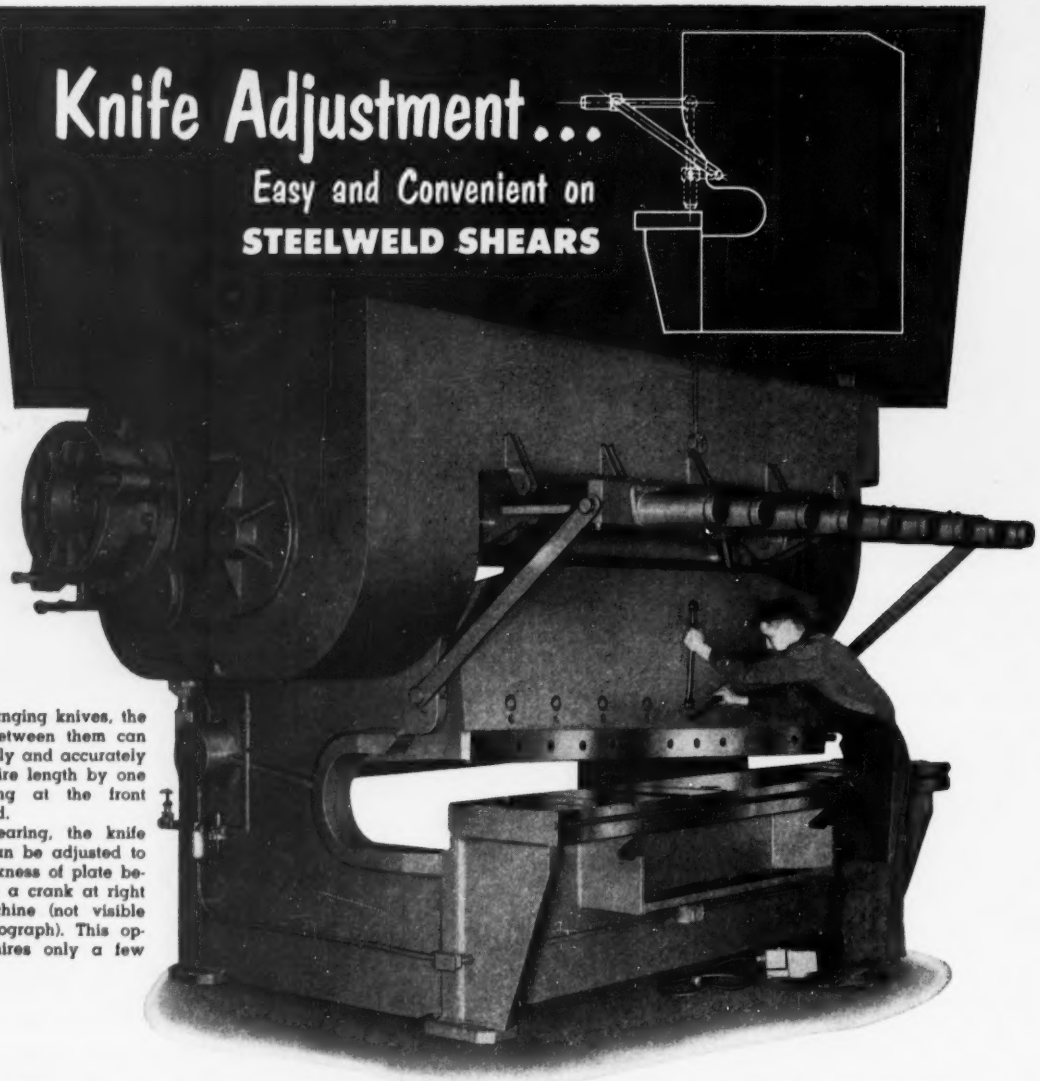


KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS

KEARNEY & TRECKER
CORPORATION
Special Machinery Division
MILWAUKEE 14, WIS., U. S. A.

Knife Adjustment...

Easy and Convenient on STEELWELD SHEARS



When changing knives, the clearance between them can be set quickly and accurately for their entire length by one man working at the front as illustrated.

When shearing, the knife clearance can be adjusted to suit the thickness of plate being cut with a crank at right end of machine (not visible in this photograph). This operation requires only a few seconds.

When the knives on a Steelweld Shear are being set parallel from one end to the other, it is not necessary to have one man at the rear of the machine turning adjustment bolts, with another man at the front gauging the knife clearance. Nor is it necessary to work between or behind the hold-downs in hard-to-reach places.

On Steelwelds the hold-down beam can be lifted out of the way and all knife adjustment bolts reached from the front of the machine. As each bolt is turned, the clearance can be checked at once. One man can make the entire adjustment in a small fraction of the time usually required.

After the knives have been set for parallel, the clearance between them can be adjusted to suit various plate thicknesses to obtain the best possible cuts. This can be done in a few seconds by turning a crank and watching a dial indicator.

Because knife adjustments have been made so convenient on Steelwelds, shear operators will make them gladly and without hesitation. This contributes greatly to accuracy and quality of cuts and assures long knife life.

GET THIS BOOK!

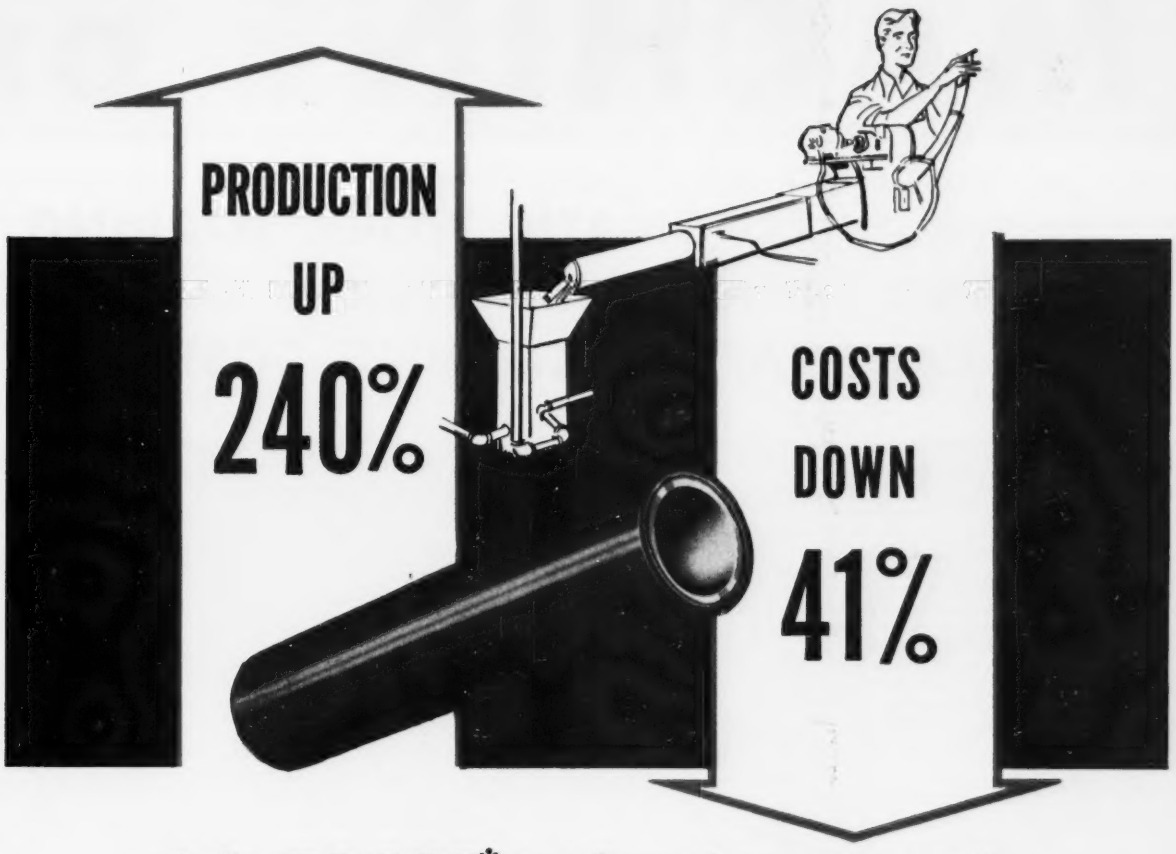
CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

5438 E. 282 ST., WICKLIFFE, OHIO

STEELWELD PIVOTED BLADE SHEARS

For more information on products advertised, use Inquiry Card, page 247



with TOCCO* Induction Heating

Whether you're interested in upping production or downing costs—or both—it pays to investigate TOCCO Induction Heating if you heat-treat, anneal, braze, solder, forge or melt ferrous or non-ferrous metal parts.

PRODUCTION UP—When Thompson Products Ltd., St. Catharines, Ontario switched from conventional methods to TOCCO Induction Hardening of their automotive wrist pins, production rose from 500 to 1200 per hour.

COSTS DOWN—While production jumped, costs fell from $5.46 per hundred parts to $3.23—a savings of more than 2c per pin or $26.76 per hour on the hardening operation alone.

OTHER ADVANTAGES—Additional savings result from elimination of hauling wrist pins to and from the heat-treat department. Cool, clean TOCCO fits right in the production line, next to related operations—takes only ¼ the space of the pusher-type furnace previously used.

In Canada or the United States TOCCO engineers are glad to survey your operations for similar cost-cutting results—no obligation, of course.

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today

NEW FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. M-5, Cleveland 1, Ohio

Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating".

Name_____

Position_____

Company_____

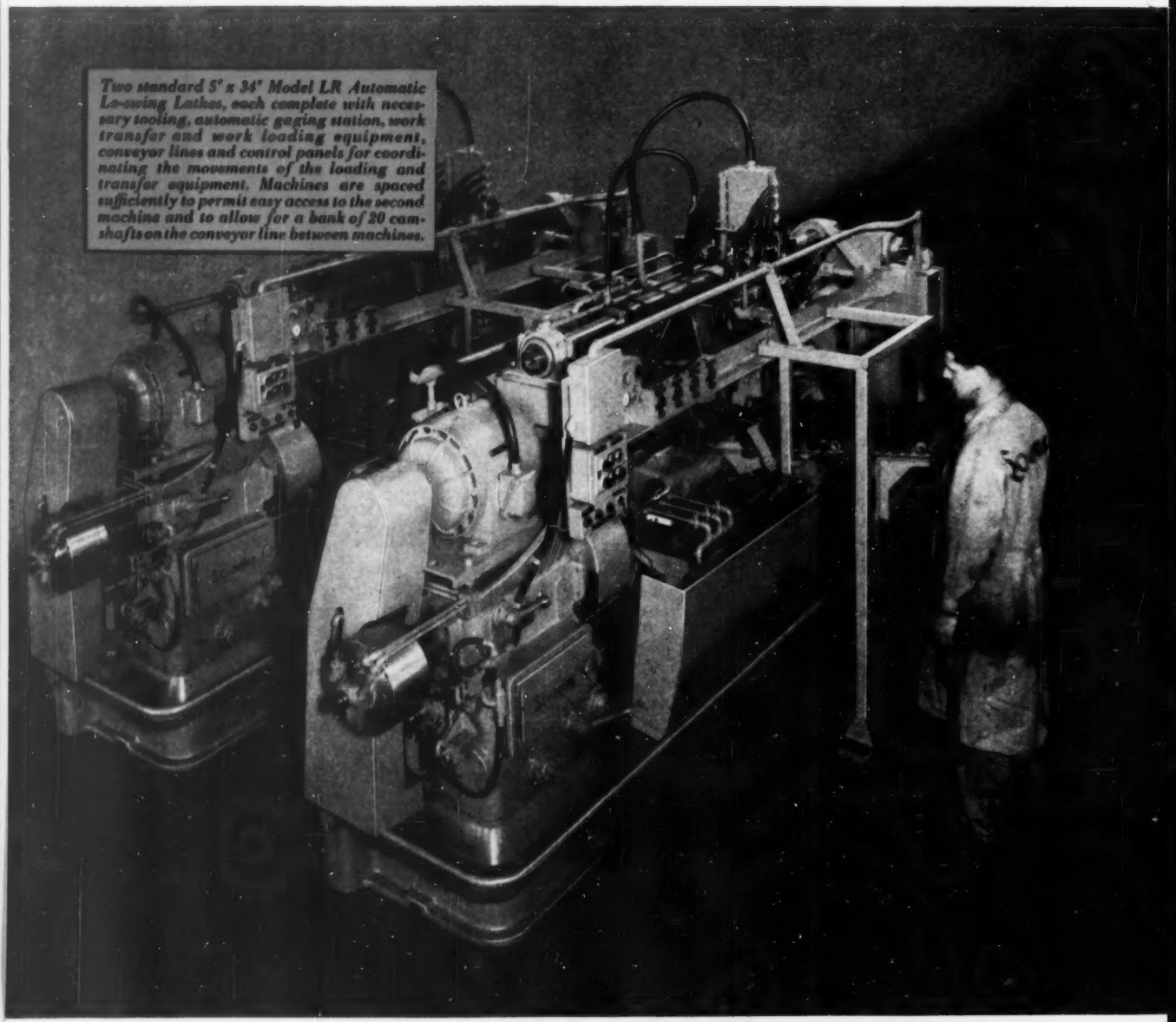
Address_____

City_____ Zone____ State_____

For more information on products advertised, use Inquiry Card, page 247

MACHINE OF

Lo-swing AUTOMATIC WORK LOADING AND TRANSFER EQUIPMENT CUTS CAMSHAFT MACHINING COSTS

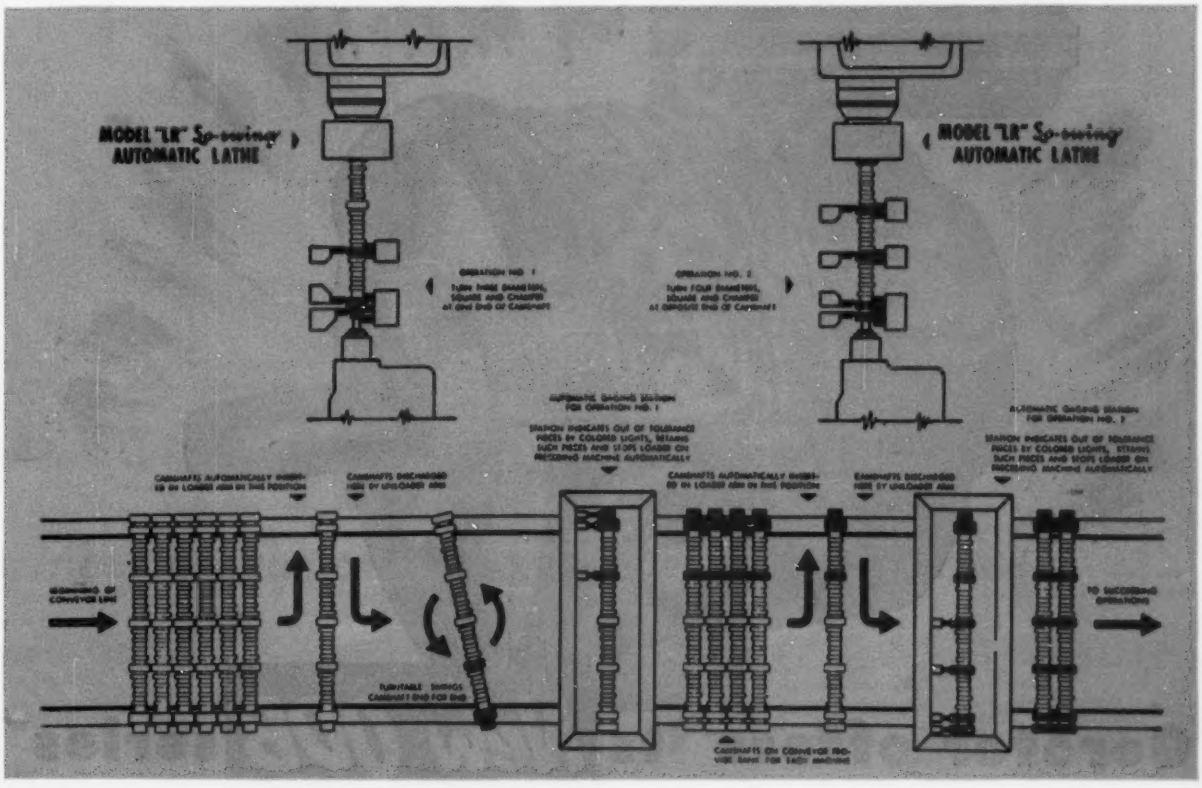


Two standard 5" x 34" Model LR Automatic Lo-swing Lathes, each complete with necessary tooling, automatic gaging station, work transfer and work loading equipment, conveyor lines and control panels for coordinating the movements of the loading and transfer equipment. Machines are spaced sufficiently to permit easy access to the second machine and to allow for a bank of 20 camshafts on the conveyor line between machines.

PRODUCTION COSTS

THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK



PROBLEM: To automatically load, transfer and process camshafts through two machining and two gaging operations.

SOLUTION: The Lo-swing Automation Method selected comprised two Model LR Lo-swing Lathes complete with necessary tooling, Lo-swing automatic work loading and transfer equipment, automatic gaging stations and the necessary control system.

The tooling is designed for rapid replacement. The front turning tools are fitted with adjusting screws which are pre-set in the tool room after the tools are ground. No tool setting is required at the machine. The rear facing and chamfering tools are mounted in magazine type tool blocks which are quickly replaced by other magazine blocks having pre-set tools.

The installation requires no operator and is so designed that cycle time on individual machines may vary without disrupting overall operation. Safety and quality control devices instantly detect and signal off-tolerance pieces. The gaging instruments employed are electrically-operated, trouble-free, accurate and fool-proof.

Significant advantages of this Lo-swing Automation Method are:

- Elimination of operator fatigue due to mechanical handling.
- Reduction of labor and unit costs due to automatically controlled machining and handling time.
- Improved quality control due to automatic gaging as each piece leaves the machine.
- Reduction in work spoilage and salvage expense.
- Reduction in number of operators required for a production line.
- Elimination of damage to parts which frequently occurs with hand loading.
- Reduction of accidents due to limitation of human reflexes.
- Straight line conveyor feeding which simplifies plant layout.

Write for your personal copy of the new Lo-swing brochure, "Automation is the Answer", which illustrates and describes Lo-swing Automation Methods in detail.

ARE LOWER WITH Lo-swing

EVEN CAN BE IMPROVED

Gerotor offers its *New QDB* series of small capacity pumps as proof!

Gerotor has redesigned its series of small capacity pumps to give even more . . .

- **FLEXIBILITY**—the QDB can be operated in either clockwise or counterclockwise direction by simply changing the position of one internal plug!
- **RANGE OF APPLICATION**—the QDB can be obtained with an extended shaft to operate another pump in tandem, off of one motor!
- **DEPENDABLE SERVICE**—the QDB is built to give more dependable service over a longer service span than any comparable pump. Its longer life reduces your maintenance and replacement costs.

If you have need for pumps in the QDB range, call on Gerotor.

Gerotor makes a complete line of hydraulic pumps in ranges from .4 g.p.m. to 40 g.p.m. The Gerotor engineers can help you solve your hydraulic pump problems. Write for *free literature* and full particulars.

Check this capacity table . . .

Delivery g.p.m.—1800 r.p.m.					
Type	Discharge Pressure p.s.i.				
	0	250	500	750	1000
QDB .4	.42	.40	.38	.35	.31
QDB .75	.84	.80	.78	.73	.66
QDB 1.5	1.67	1.62	1.57	1.50	1.42

GEROTOR MAY CORP. - Box 86 - Baltimore 3, Md.

GEROTOR
HYDRAULIC PUMPS & MOTORS

For more information on products advertised, use Inquiry Card, page 247

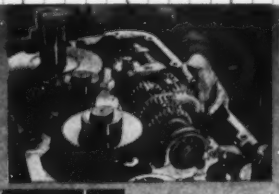
1 2 3

Dark areas show generous depth of flame-hardened surfaces on sections cut from Axelson 32" lathe carriage bedways. The dimensions indicate the greater width of Axelson ways.

Carriage and cross slide are massive without being bulky; compound is cast steel; tailstock is 2-speed.

Apron pump supplies controlled oil flow to carriage bedways, cross slide on 20" D, and 15" and 32". Controlled oil flow to tool slide and lead screw split nut on all models.

CRITICAL DIMENSIONS STAY PUT ON AXELSON LATHES



All apron gears, including sliding bevel gears, are enclosed within apron, immersed in oil and safeguarded from dirt and chips.

All bearing surfaces on headstock, carriage, cross slide, tool slide, tailstock are hand-scraped to insure absolute precision.

20" precision, 24 speed, tool room lathe.

AXELSON MANUFACTURING COMPANY DIVISION

PRESSED STEEL CAR COMPANY, INC.

LOS ANGELES 58, ST. LOUIS 16, NEW YORK 7, TULSA 1

RAILROAD FREIGHT CARS • STANDARD PARTS • DAIRY & FARM EQUIPMENT • WASTE CONTAINERS • STAINLESS STEEL COOKWARE CAR ACCESSORIES • TANKS • AGITATORS • SHOVEL STACKS DUST COLLECTORS • COAL & ASH HOPPERS • FITTINGS & ELECTRICAL ACCESSORIES • ORDNANCE MATERIEL • UNDERFRAMES • UNDERSHELTER RELOCATABLE HOMES • EXPORT ONLY, LOCOMOTIVES & TRACKWORK CARS (MINE, ORE, CANE, INSPECTION) • UNISTRUT METAL FRAMING WEED BURNERS • BRICK & TILE MACHINERY • CANE LOADERS

LATHES, ENGINE • TOOL ROOM • HOLLOW SPINDLE • GAP BED PETROLEUM PUMPING EQUIPMENT. DEEP WELL PLUNGER PUMPS SUCKER RODS • HYDRAULIC PUMPING UNITS • AIRCRAFT COMPONENTS

ROLLWAY

Tru-Rol

ROLLER BEARINGS

The Right Balance Between Precision and Economy

Rollway's Tru-Rol Cylindrical Roller Bearings fill a well-defined need . . . afford the design engineer much wider latitude in balancing performance and reasonable cost.

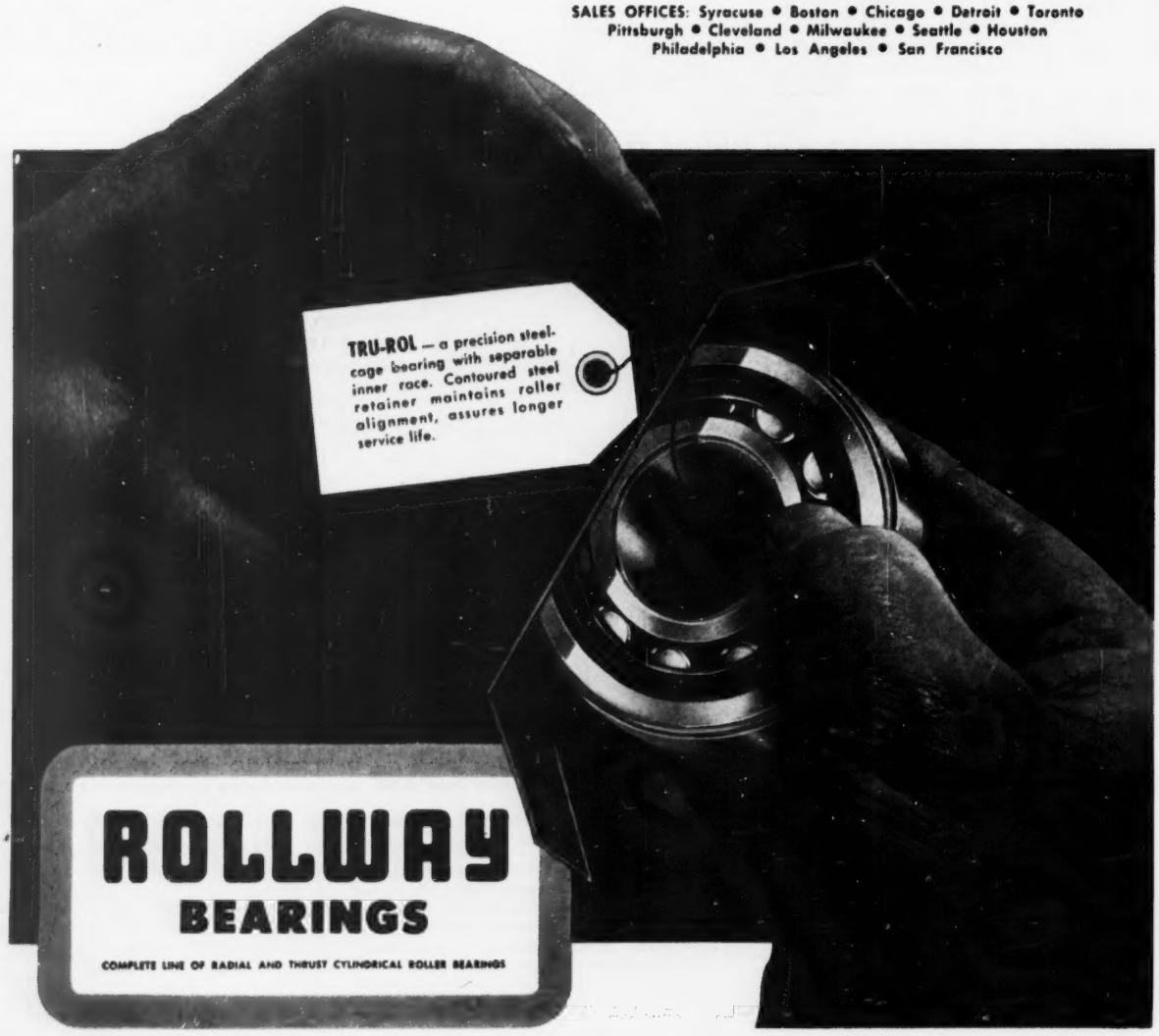
A steel-cage bearing in the steel-cage cost range, Tru-Rol boasts true and precise rolling approaching that of bronze-separator types. That's because of the exclusive Rollway guide-lip . . . an ingenious, low-cost feature that prevents roller-skewing, sliding friction and excessive wear. Investigate Tru-Rol's outstanding record before you specify bearings in the medium price range.

Our complete engineering and metallurgical services will gladly work with you on your problem. Simply write or wire any sales office. No cost. No obligation.

Rollway Bearing replacements are available through authorized distributors in principal cities. Consult your classified phone directory.

ROLLWAY BEARING CO., INC.
SYRACUSE, N. Y.

SALES OFFICES: Syracuse • Boston • Chicago • Detroit • Toronto
Pittsburgh • Cleveland • Milwaukee • Seattle • Houston
Philadelphia • Los Angeles • San Francisco


TRU-ROL — a precision steel-cage bearing with separable inner race. Contoured steel retainer maintains roller alignment, assures longer service life.
ROLLWAY
BEARINGS
COMPLETE LINE OF RADIAL AND THRUST CYLINDRICAL ROLLER BEARINGS

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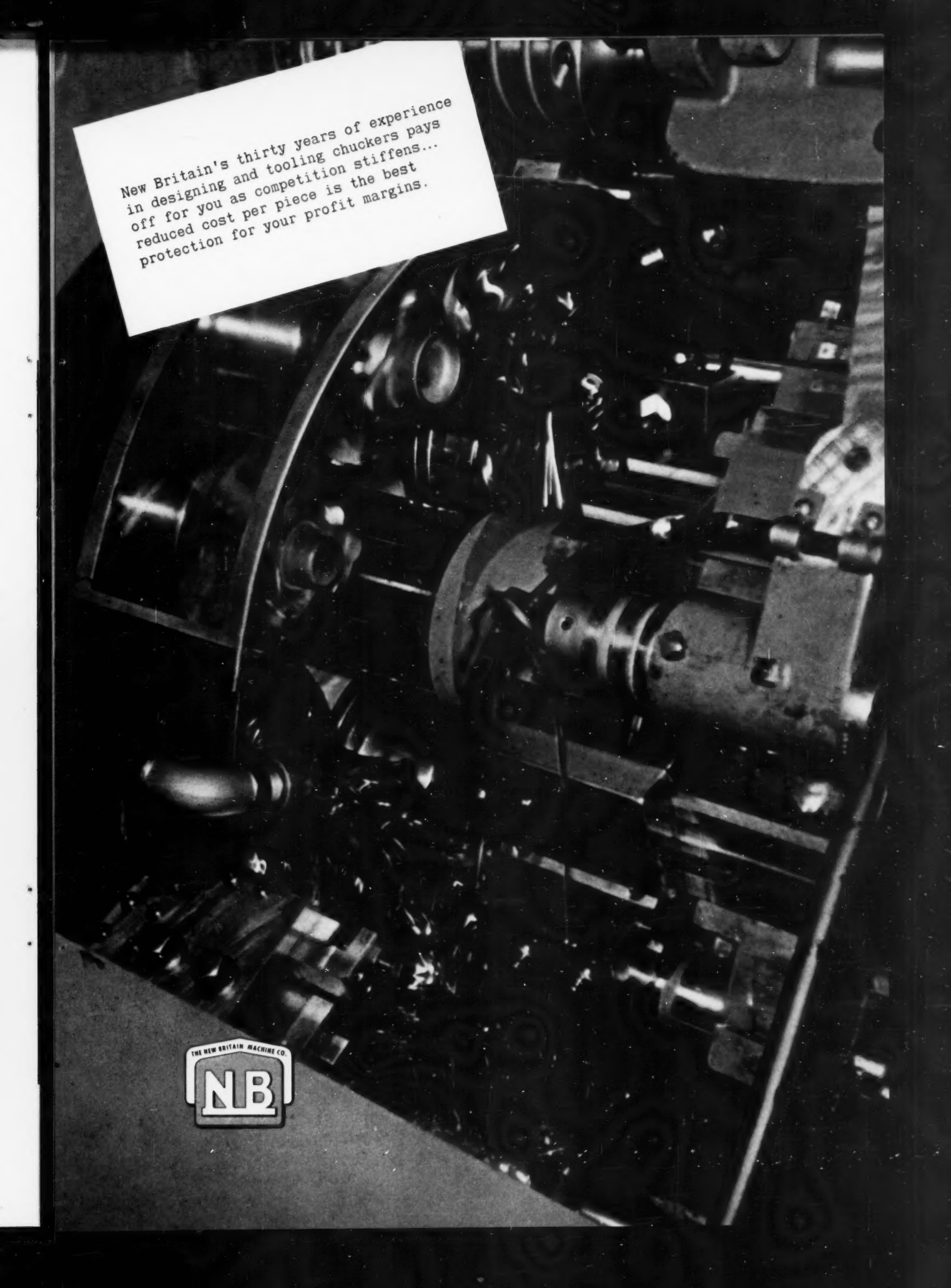
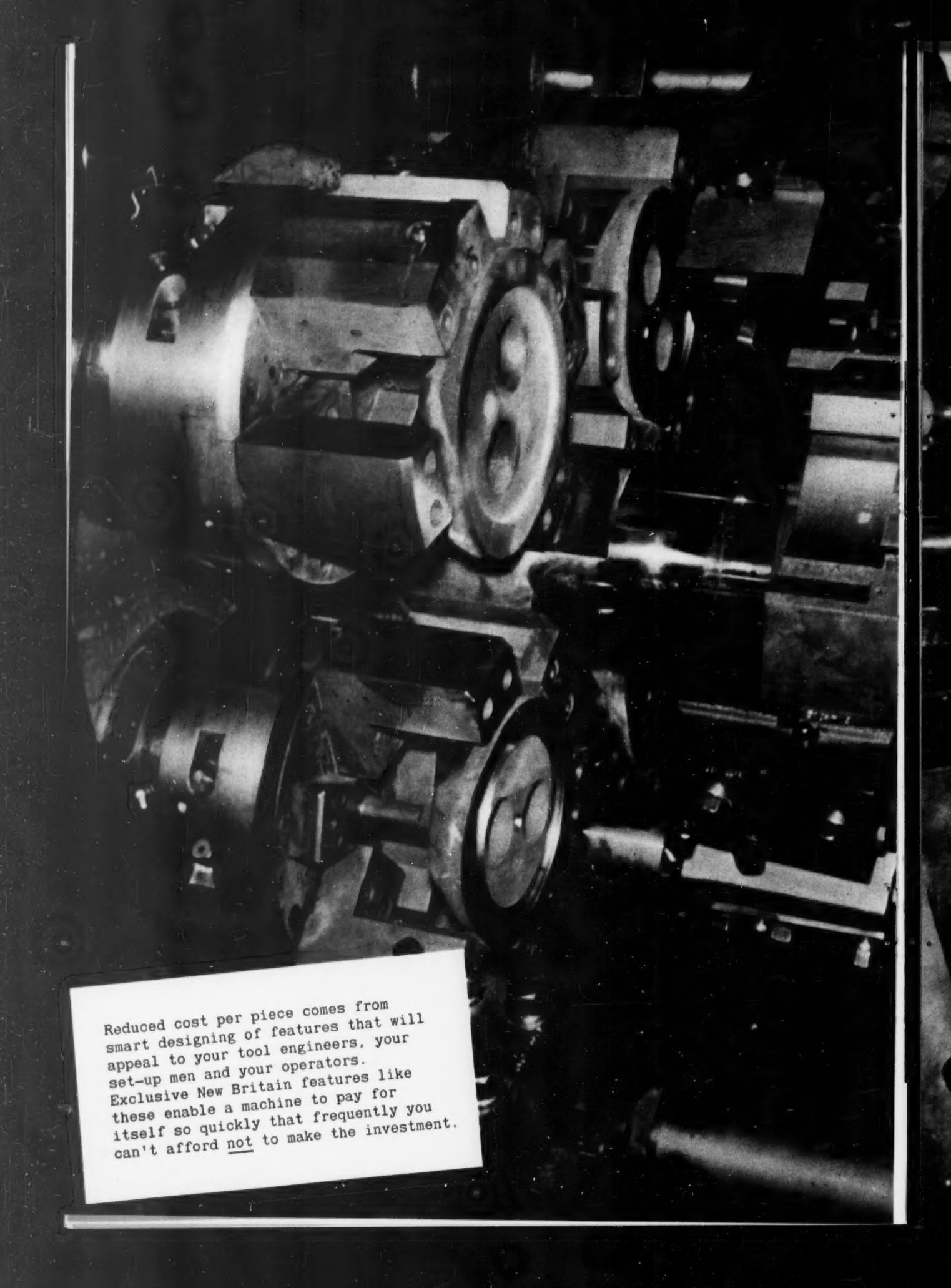
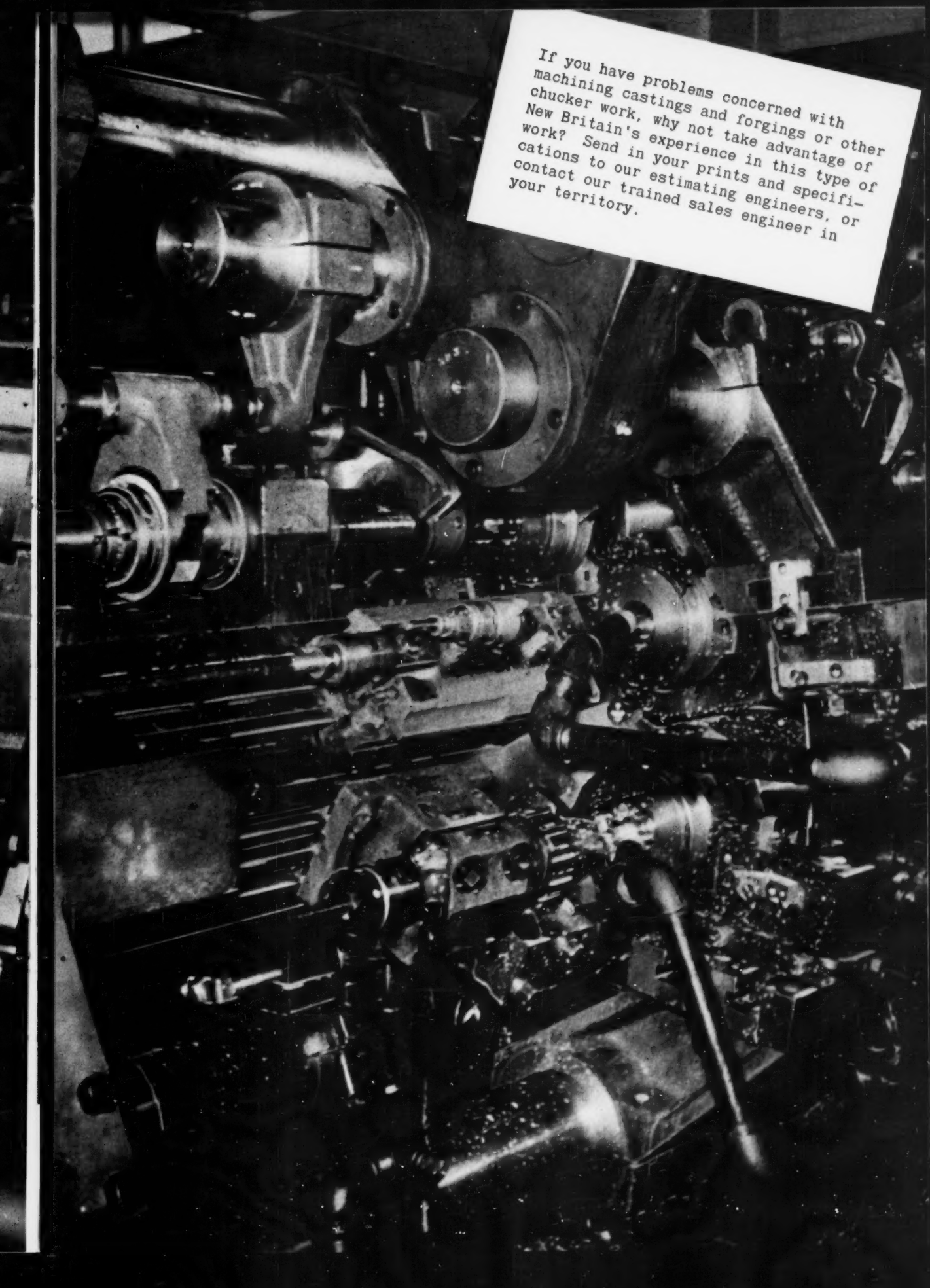

New Britain's thirty years of experience
in designing and tooling chuckers pays
off for you as competition stiffens...
reduced cost per piece is the best
protection for your profit margins.
THE NEW BRITAIN MACHINE CO.
NB



Reduced cost per piece comes from smart designing of features that will appeal to your tool engineers, your set-up men and your operators. Exclusive New Britain features like these enable a machine to pay for itself so quickly that frequently you can't afford not to make the investment.

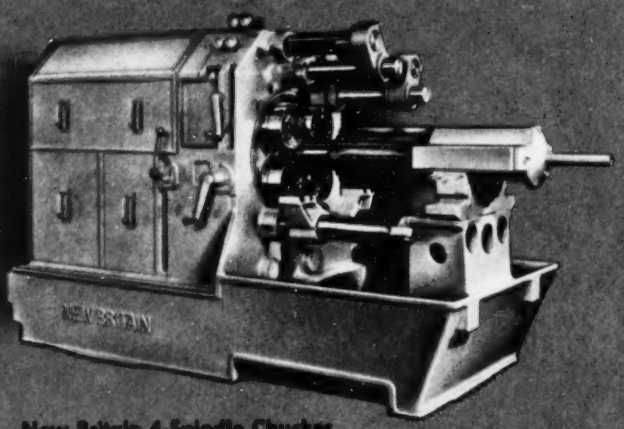


If you have problems concerned with machining castings and forgings or other chucker work, why not take advantage of New Britain's experience in this type of work? Send in your prints and specifications to our estimating engineers, or contact our trained sales engineer in your territory.

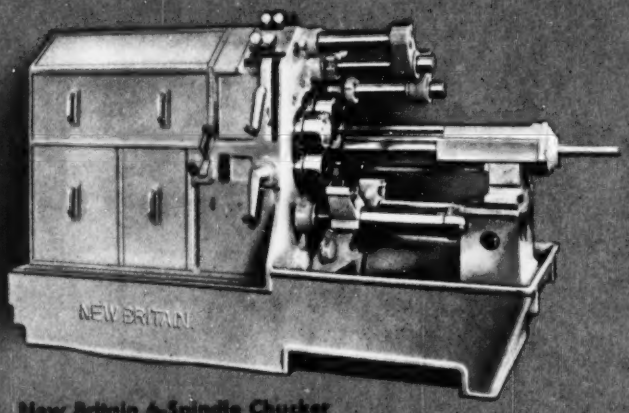
SUSTAINED ACCURACY and PRODUCTIVITY

New Britain open end chuckers feature wide-open accessibility to all tools, and convenient chip removal, with power and rigidity to handle the heaviest cuts. Their high initial accuracy is preserved by such exclusive features as automatic spindle carrier lifting and clamping which prevent wear and weave. Swinging-type forming arms are positionable horizontally and radially without overhang and without exposed surfaces to be affected by grit or chips. They have both radial and longitudinal motion and will handle any length or diameter job within the machine's capacity.

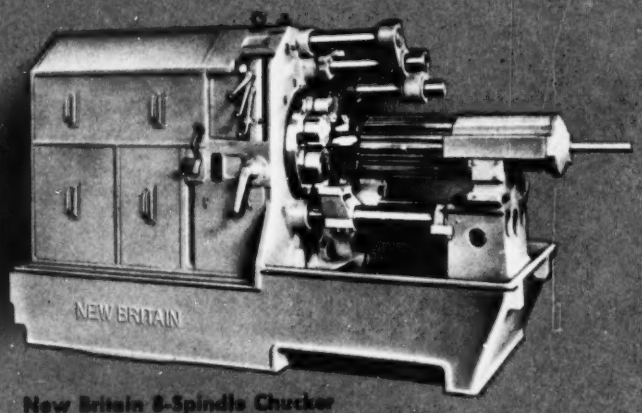
For full information, write us, or consult the New Britain Sales Engineer in your area.



New Britain 4-Spindle Chucker



New Britain 6-Spindle Chucker



New Britain 8-Spindle Chucker

Our general catalog is filed in the Sweet's Machine Tool Catalog File.

AUTOMATIC BAR and CHUCKING MACHINES • PRECISION BORING MACHINES
LUCAS HORIZONTAL BORING, DRILLING and MILLING MACHINES
NEW BRITAIN +8F+ COPYING LATHES

The NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division, New Britain, Connecticut
Lucas Machine Division, Cleveland 8, Ohio

MEET THE CINCINNATI 19" Hydroform

Here is the newest member of the Cincinnati Hydroform family . . . a 19" machine which provides manufacturers with facilities for producing parts from blanks up to 19" in diameter, having a maximum drawn depth of 8". Material thickness of the formed part can range up to ⅜" cold rolled steel. A maximum forming cavity pressure of 15,000 psi provides the same high degree of formability that is available in the 12" and 26" Hydroform machines. Many intricate shapes can be formed in one operation, as the percentage of reduction in the draw is far greater than is obtainable by conventional practice.

The hydraulic power unit for the 19" Hydroform is pit mounted to provide unobstructed floor space surrounding the machine. With this arrangement, the machine occupies an area only six feet square at floor level. Machine height above floor level is 11⅓ feet.

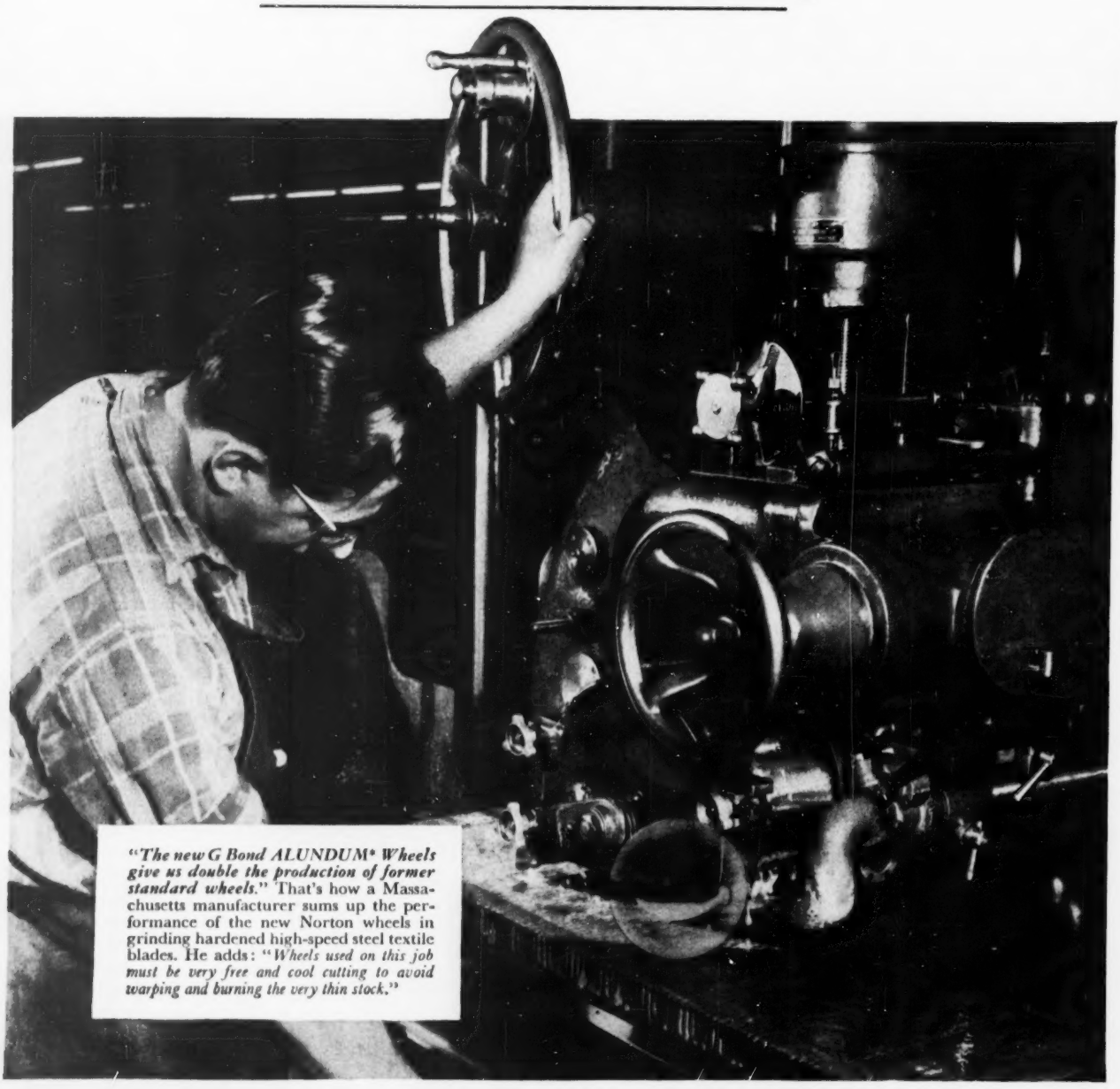
Since the introduction of Hydroforming, this revolutionary deep drawing process has been widely accepted. Now, Hydroform machines are being employed on an extremely broad range of development work and on short run and quantity production.

Is your company fully informed of the many Hydroforming advantages? Let a Cincinnati Milling field engineer give you complete details. For general Hydroform data and specifications of the 8", 12", 19", 23", 26" and 32" Hydroform machines, write for your copy of Bulletin M-1759-3.

CINCINNATI Hydroform **THE CINCINNATI MILLING MACHINE CO.**
CINCINNATI 9, OHIO, U.S.A.

These users say:

For surface grinding, the new G BOND beats them all!



"The new G Bond ALUNDUM® Wheels give us double the production of former standard wheels." That's how a Massachusetts manufacturer sums up the performance of the new Norton wheels in grinding hardened high-speed steel textile blades. He adds: *"Wheels used on this job must be very free and cool cutting to avoid warping and burning the very thin stock."*

Latest Norton wheels bring you the money-saving

"TOUCH of GOLD"

Naturally, we've kept close watch on how the new G Bond wheels are doing. And we can report that throughout the range of precision and semi-precision grinding applications they're already away out in front. In the field of surface grinding, for instance, a composite statement by users of the new G Bond would run very much like this:

"G Bond wheels cut freer, cooler, faster — enabling us to take heavier cuts in costly high speed steels without drawing temper. They give us closer tolerances and smoother finishes. They dress easier and produce more pieces per dressing. Doing more work and a greater variety of work — per wheel, they outlast any wheels we ever used before."

G Bond Wheels for YOUR Surface Grinding

will bring new speed and economy to surface grinding jobs — thanks to their unique grain-holding structure that produces greatly improved cutting action. Remember, the G Bond is the most modern, most efficient vitrified bond ever developed — a typical Norton "Touch of Gold" achievement that steps up grinding performance and product quality while cutting grinding costs.

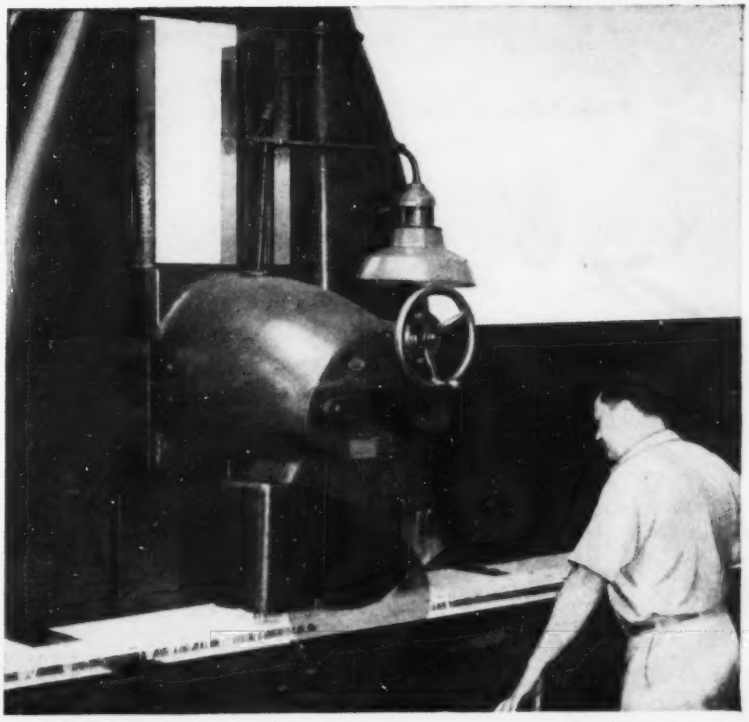
See Your Norton Distributor

for the ALUNDUM G Bond wheels, cylinders and segments you need. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your classified phone directory. *Export:* Norton Behr-Manning Overseas Inc., Worcester 6, Massachusetts. W-1535

NORTON
ABRASIVES

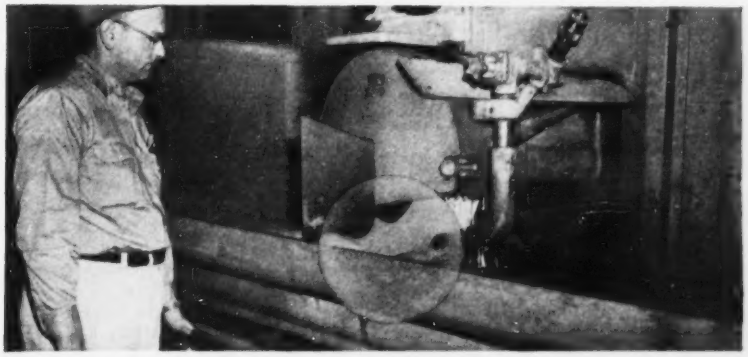
Making better products... to make other products better

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries



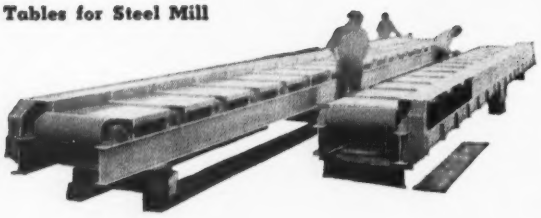
***"Thirty per cent longer wheel life**, freer and cooler cutting, a good finish and more pieces per dressing,"* are G Bond advantages cited by an Ohio machine tool company on this surface grinding job. Material on job illustrated is flame-hardened graphitic tool steel.

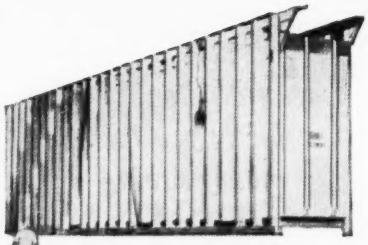
***"I get a fast cut and good finish.** They're the best and most versatile segments I ever used for this kind of work and I'm re-ordering ten sets,"* reports an Illinois customer using G Bond segments for surface grinding mild steel, cast iron and Meehanite — all three.



***"We're getting forty per cent more wheel life from G Bond wheels, and they cost us twelve per cent less because now we don't need a premium priced abrasive.** The new bond has proved excellent for grinding our laminated stainless steel and mild steel magnetic chuck plates."* This from a Michigan manufacturer.

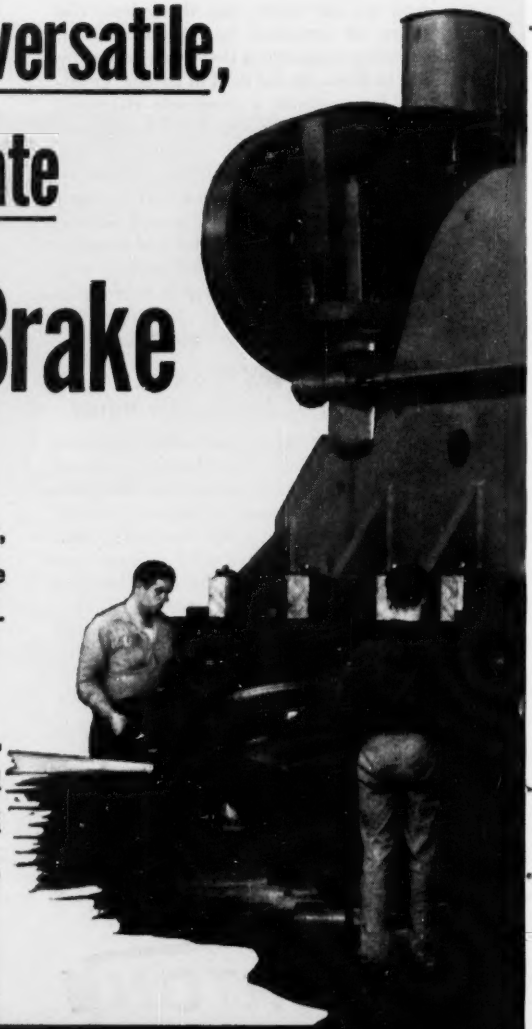
• Roll Tables for Steel Mill





• 30-Ton Electrolytic Plating Tank

do it... on a versatile, accurate Cincinnati Press Brake



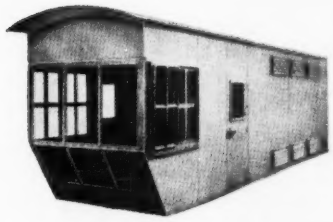
At Charles T. Brandt, Inc. speed, accuracy, and versatility are necessary to take care of large or small work in jobbing or production quantities.

Write for the New 72 Page Catalog B-4, describing operations, features, and special arrangements including wide beds and rams, bed and ram extensions, deeper gaps, higher die space and other features.

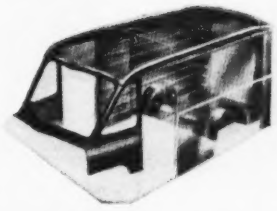
CINCINNATI

THE CINCINNATI SHAPER CO.

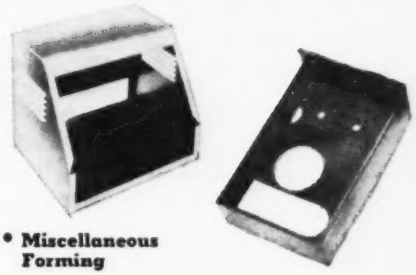
CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES



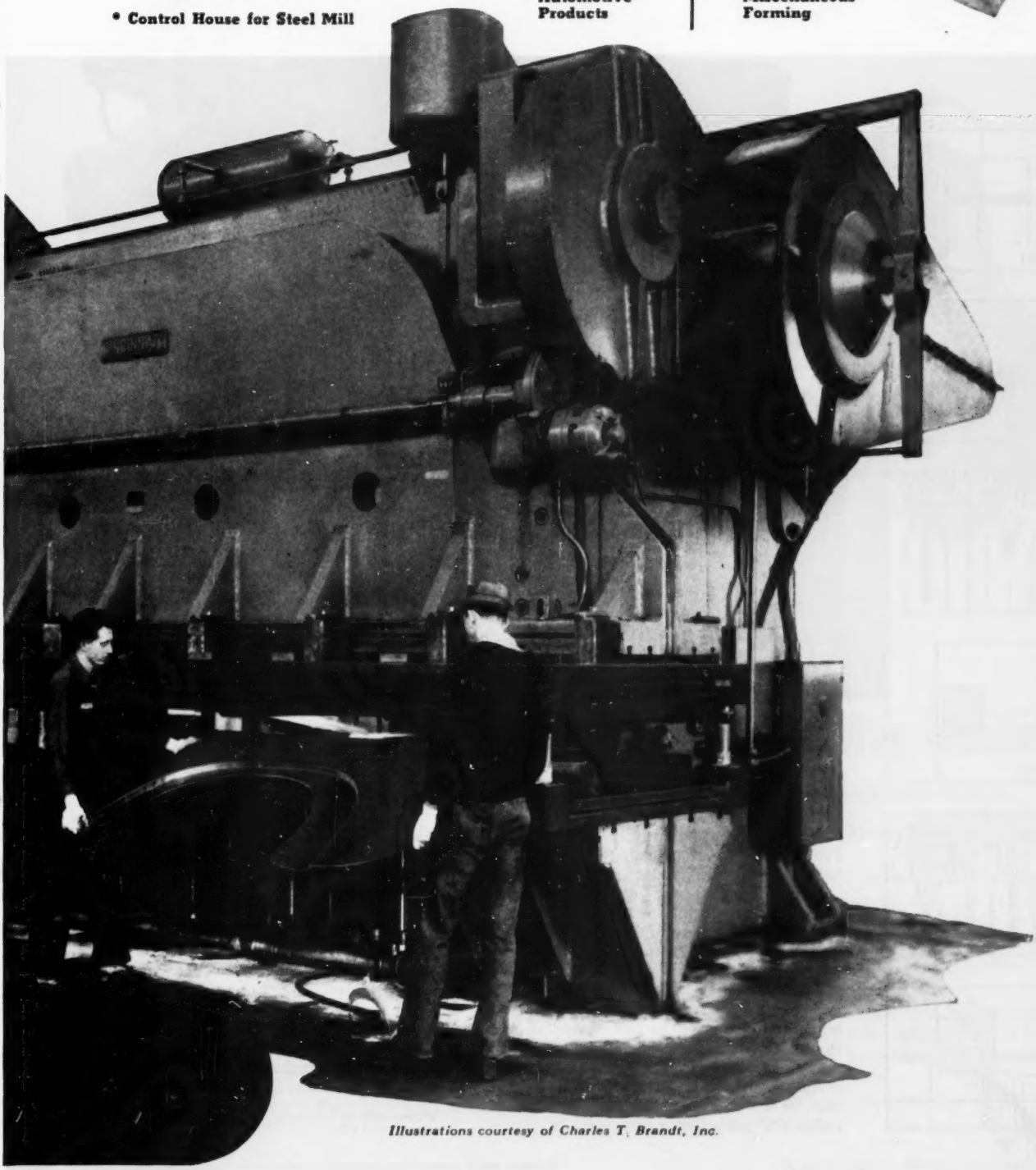
• Control House for Steel Mill



• Automotive Products

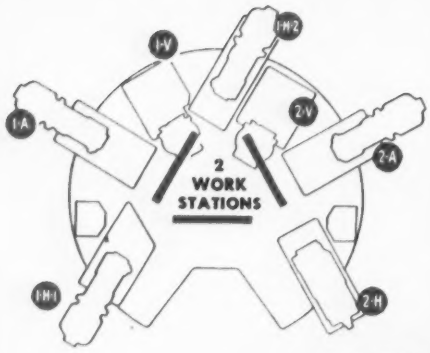


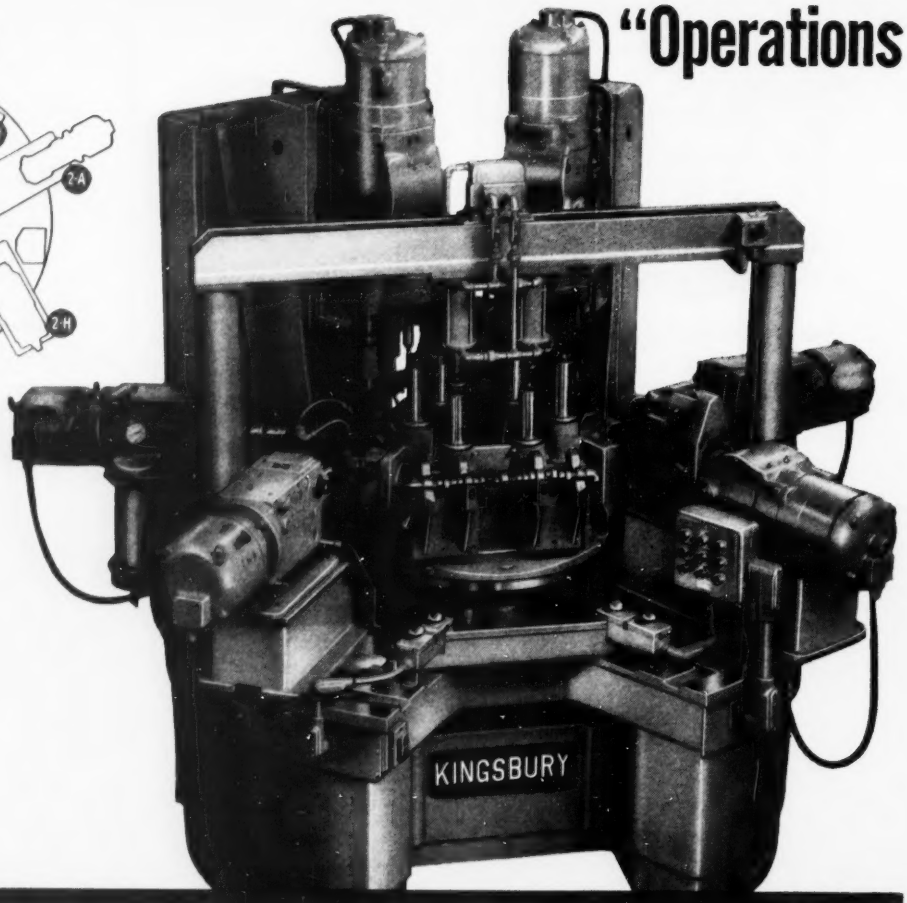
• Miscellaneous Forming

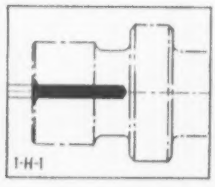


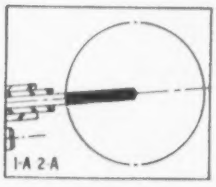
Illustrations courtesy of Charles T. Brandt, Inc.

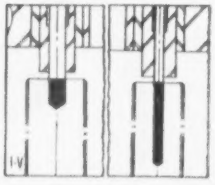
"Operations

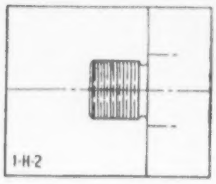


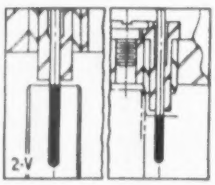


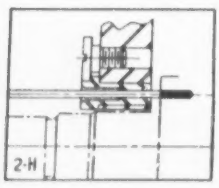


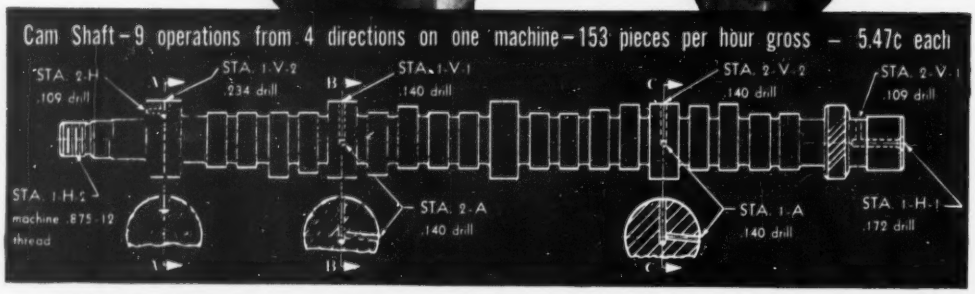











Cam Shaft – 9 operations from 4 directions on one machine – 153 pieces per hour gross – 5.47c each
STA. 2-H .109 drill
STA. 1-V-2 .234 drill
STA. 1-V-1 .140 drill
STA. 2-V-2 .140 drill
STA. 2-V-1 .109 drill
STA. 1-H-2 machine .875-12 thread
STA. 2-A .140 drill
STA. 1-A .140 drill
STA. 1-H-1 .172 drill
A
B
C

Watch these two Kingsburys perform 23

This machine cuts a thread and drills eight holes.

The part is a cam shaft, 22 inches long. Print called for a thread, two longitudinal holes, 6 cross holes, and a milled keyway.

The threading and drilling operations could all be performed within the time cycle required for maximum production. The milling operation required more time. It was decided to build two Kingsburys: an indexing machine with 80-inch base and 30-inch table; and a non-indexing multi-way machine to perform the milling operation on two pieces.

Indexing Kingsbury: Machine has three stations: one for loading and unloading and two for work. This required that the table index 120° each time.

Seven Kingsbury Units*, mounted on the base, perform all operations at two stations.

Station 1: Unit 1-H-1 drills .172 dia. axial hole $1\frac{5}{16}$ inches deep in end. Unit 1-A drills .140 dia. hole 1 inch deep at C-C. Unit 1-V has two spindles. One spindle drills .140 dia. hole $1\frac{1}{8}$ inches deep at B-B; the other drills .234 dia. hole $\frac{11}{32}$ inch deep at A-A. Unit 1-H-2 threads .875-12 end of shaft.

Station 2: Unit 2-V has two spindles. One spindle drills .109 dia. hole to connect at 90° with hole drilled by Unit 1-H-1; the

*Three units are Horizontal (H), two at an Angle (A) and two are Vertical (V).

Kingsbury" means Precision with High Production

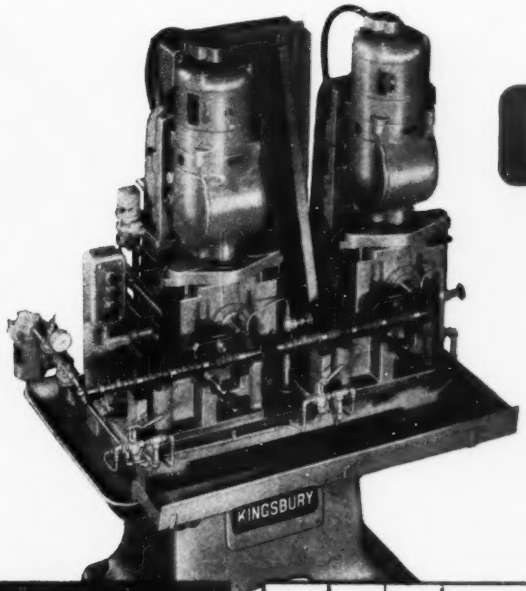
The term "Precision — with High Production" covers a lot of territory. Precision is essential — high production optional. A giant indexing machine with nine working stations pays for itself because it drills, reams, c'sinks, hollow-mills, taps and threads a simple, inexpensive valve body to the tune of 550 pieces per hour. A non-indexing machine pays by performing a single milling operation on an expensive cam shaft.

Combining operations increases production, insures interchangeability with its required accuracy, reduces handling, practically eliminates scrap loss, releases valuable floor space . . . .

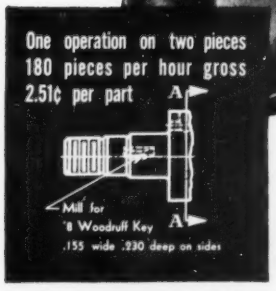
All these considerations add up to make a Kingsbury a wise investment.

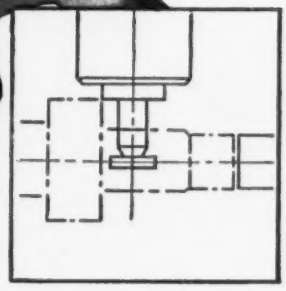
Are you really interested? If so, we'd like to see you.

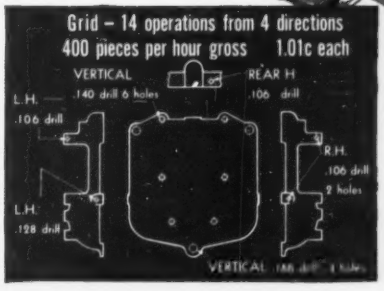
Kingsbury Machine Tool Corporation
105 Laurel St., Keene, N. H.



KINGSBURY
AUTOMATIC DRILLING AND TAPPING MACHINES
for Low-Cost High Production







+3 operations per minute

This machine mills a keyway.

other drills .140 dia. hole 1⅛ inches deep at C-C. Unit 2-A drills .140 dia. hole 1 inch deep at B-B. Unit 2-H drills .109 dia. hole to connect at 90° with hole drilled at A-A by Unit 1-V.

At the loading station a pair of pneumatic rams release the locking devices which locate and clamp the shaft securely in the work fixture. Bushings located in the fixture guide all drills.

The nine operations are accomplished in approximately 24 seconds, permitting ample time for loading and unloading.

Multi-Way Kingsbury: Machine has two units arranged in line, with two work fixtures. Each unit mills a keyway at threaded end of shaft, .155 wide and .230 deep on sides. Operator loads and unloads each work fixture alternately.

Kingsbury Multi-Way Machine

performs 93.3 operations per minute.

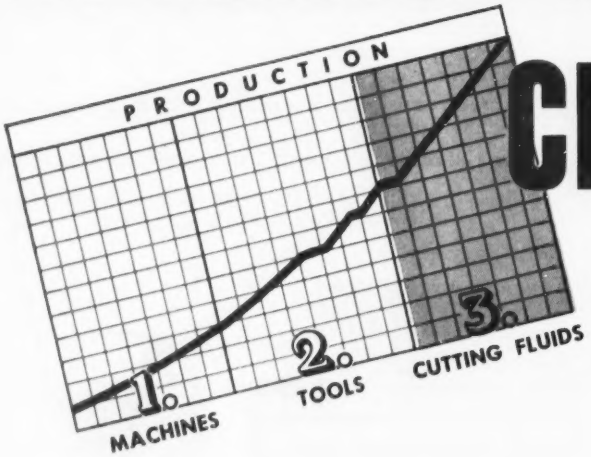
The part is a cast iron grid. The job requires 14 holes from 4 directions.

This is a good example of multiple operations in a non-indexing machine. Three horizontal and one vertical unit are located on the base so as to work directly on the part from the right, rear, left and above. The work fixture remains in one position. Machine is loaded and unloaded at the front.

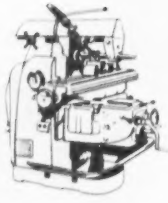
Operator locates the part on guides and moves it onto locators within the fixture. Handle mechanism locks the part in position. Bushings are located in the fixture and guide all drills.

The left and right unit have two spindles each; the vertical unit has nine spindles.

For maximum efficiency...



CHECK ALL THREE!



1 MACHINES

Several machines in your plant may be capable of performing the job at hand. You may consider two or three machines or even make test runs before deciding which is best. DO YOU ALSO CHECK SEVERAL CUTTING FLUIDS?

2 TOOLS

Carbon steel tools may do the job— but you don't hesitate to try high speed steel or carbide tools if there is a chance they can do better. DO YOU ALSO CHECK SEVERAL CUTTING FLUIDS?

3 CUTTING FLUIDS

CHECK SHEAR-SPEED Soluble Oil against your present cutting fluids and convince yourself of its amazing advantages and versatility . . . a *multi-viscosity blend* for widest range of application. It's SEVERAL CUTTING FLUIDS ALL IN ONE. Avoids gumming characteristics of paraffin oils and corrosion or staining from sulfur and chlorine additives. Sold only on a satisfaction guaranteed test basis. Write today for Bulletin SO-53 and price list.

NEW COOLANT-LUBRICANT BOOSTS TOOL LIFE 60-80% IN PRODUCTION TESTS

Impartial tests of three cutting fluids conducted in the plant of a large auto manufacturer showed an increase in tool life of 60.5% and 81.6% for the new SHEAR-SPEED Soluble Oil over two other highly rated cutting fluids. Improved surface finish and reduced down-time were clearly demonstrated in the tests with unusually uniform results obtained during all runs with SHEAR-SPEED.

On this high speed hobbing operation turning out automotive gears SHEAR-SPEED Soluble Oil averaged 18% more gears cut per tool grind than the next best cutting fluid, with 35% less tool stock removed in sharpening. All variables including coolant flow, tool grinding, cutting speed, gear steel, etc. were maintained constant during test runs. Lower tool cost and increased production

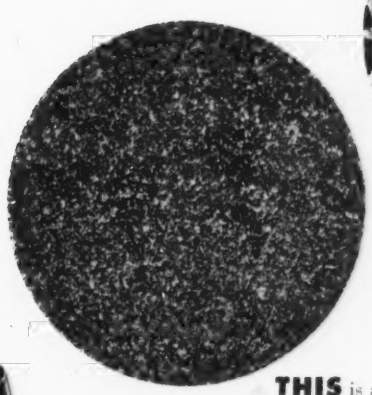
SHEAR SPEED
CHEMICAL PRODUCTS

7125 E. McNICHOLS RD. *A Division of Michigan Tool Co.* DETROIT 12, MICH.

For more information on products advertised, use Inquiry Card, page 247

You don't need 3-D glasses

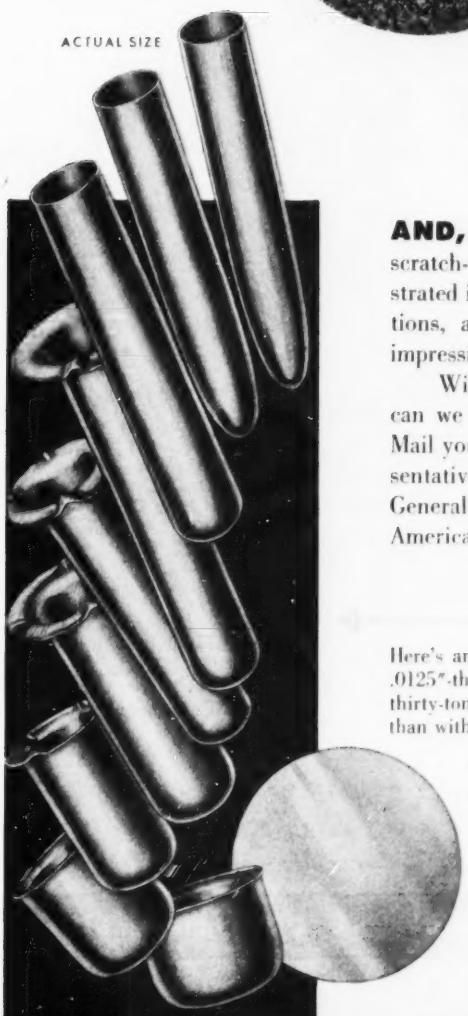
to see the difference



THIS is a 75X magnification of ordinary drawing brass—the kind that's been used for decades for stamped or drawn brass products.

THIS is a 75X magnification of super-fine-grain Formbrite.* Isn't it obvious that this new type of brass can be polished in half the time? Frequently, a simple color buff will bring up the desired finish for lacquering or plating.

ACTUAL SIZE



AND, Formbrite is harder, stronger, springier and more scratch-resistant than ordinary drawing brass, yet has demonstrated its remarkable ductility for forming and drawing operations, and ability to take sharp, clean-cut ornamental die impressions.

With all these advantages, Formbrite costs no more. What can we do to help you try this time and cost-saving metal? Mail you a booklet? Send you a sample? Ask our Sales Representative to call? Simply write to The American Brass Company, General Offices: Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario, Canada.

*Reg. U. S. Pat. Off. 5486

Here's an example of Formbrite at work. These pen caps are made of .0125"-thick Red Brass Formbrite strip at the rate of 2,000 an hour on a thirty-ton, 10-step multiple plunger press. Caps are buffed at a higher rate than with any other metal previously used.

DRAWING BRASS

an **ANACONDA** Product

made by The American Brass Company

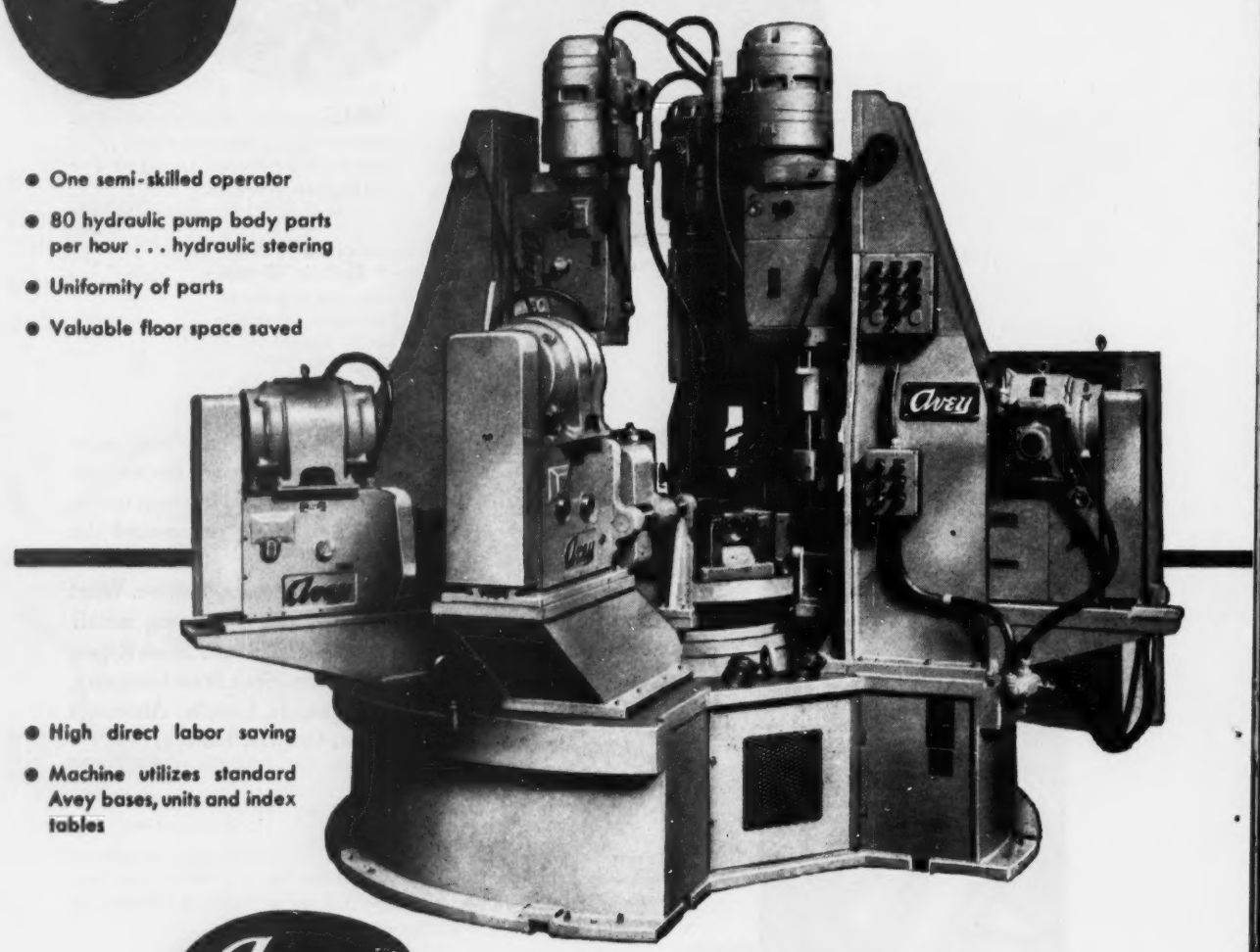
Avey

MILLING · DRILLING · TAPPING MACHINE

3 *machines in one . . .*

MILLS . . . DRILLS . . . TAPS . . .

- One semi-skilled operator
- 80 hydraulic pump body parts per hour . . . hydraulic steering
- Uniformity of parts
- Valuable floor space saved



- High direct labor saving
- Machine utilizes standard Avey bases, units and index tables

Avey

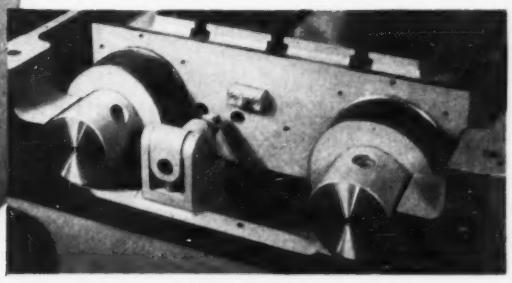
It will pay you to be up to date . . .
Write for recommendation on your jobs from Avey.

THE AVEY DRILLING MACHINE CO., Cincinnati 1, Ohio

THE BRYANT 6" STROKE *all Mechanical* BORING MACHINE

provides...

uniform accurate production



The Bryant 998 Boring Machine is a production machine for precision boring, drilling, turning, facing, grooving and contour turning and boring where fine finish and rapid production are desired.

Constant repetitive accuracy is designed into the Bryant 998. The table is mechanically actuated by a simple cam and lever unit. The cycle is positive . . . free from variation due to temperature change.

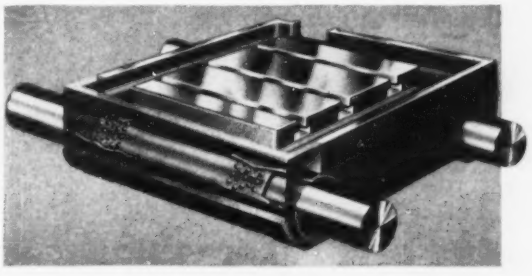
The table moves on two 4" dia. hardened and ground solid steel bars firmly bolted to the bed. Each slide bar has two widely separated bearings — hardened steel sleeves surrounding retainers in which 150 balls of ⅜" diameter are mounted under preload.

This rugged slide construction provides metal-to-metal contact, resists loads from any direction, provides sensitive response and uniform travel.

The Bryant 998 will withstand heavy use and will continue to produce parts within tolerance at the specified production rate.

Specifications

Total table stroke	6"
Top of table to top of bridge	4"
Width of bridge	27⅜"
Multiple boring heads as required by tooling to a maximum of (4) 209 heads	
Table dimensions	17½" x 22"
Floor space (without coolant tank)	31" x 54"



Mail coupon for complete details!

BRYANT CHUCKING GRINDER CO.
SPRINGFIELD, VT.

Gentlemen: Please send me your Bulletin 998. M

Name.....

Title.....

Company.....

Street.....

City.....Zone....State.....

BRYANT Chucking Grinder Co.
SPRINGFIELD, VERMONT, U. S. A.

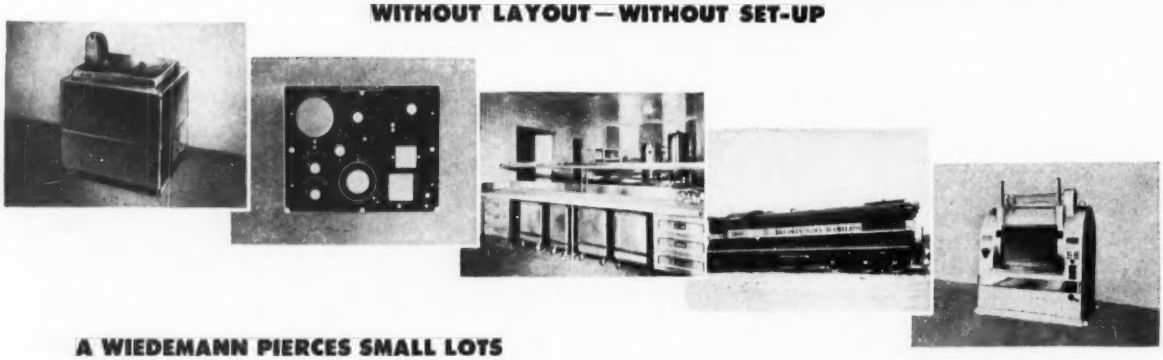
Internal Grinders • Boring Machines
Internal & External Thread Gages • Granite Surface Plates

Wiedemann Turret Punch Presses

Pay Off IN TWO YEARS OR LESS . . .
(4000 hours of operation)

precision-pierced parts of these and similar products are produced in small lots with low tooling cost

WITHOUT LAYOUT—WITHOUT SET-UP



A WIEDEMANN PIERCES SMALL LOTS COMPLETE, IN LESS TIME THAN LAYOUT BY CONVENTIONAL METHODS

We'll gladly make a time study on your work.

WIEDEMANN MACHINE COMPANY

4205 Wissahickon Avenue, Philadelphia 32, Pa.

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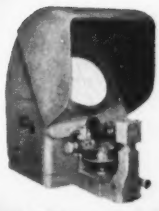
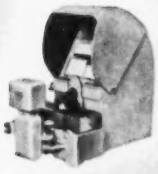
11 MODELS

3 SCREEN SIZES

Pedestal Type
14" Diam. Screen



Bench Type
14" Diam. Screen
4 Models



Bench Type
5¾" x 7¾" Screen
3 Models

Unsurpassed Inspection Versatility

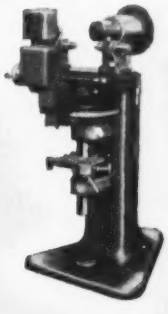
JONES & LAMSON OPTICAL COMPARATORS

The Essence of Quality Control

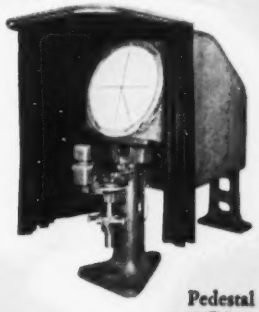
Jones & Lamson Optical Comparators are designed and built like rugged machine tools to withstand vibration and hard use. Yet they have the built-in accuracy to satisfy the most exacting laboratory standards.

- **They meet** the requirements of toolroom, laboratory and production inspection.
- **They precisely measure** height, depth, lead or spacing, as well as angles to degrees and minutes. They will measure to .0001".
- **They compare** intricately contoured parts with a master outline—and measure the amount of error.
- **They are convenient** to operate, easy to set up and read direct—*without computation.*
- **They operate** under normal lighting conditions. *No darkroom is needed.*
- **They will photograph** the enlarged shadow and record its relationship to a master chart.
- **Several persons** may study the shadow *at the same time.*
- **They will inspect** and measure surface contours, as well as profiles of objects such as type faces, stamping dies, punches, worn tools, etc.

Vertical Type
14" Diam. Screen



Direct
Projection
Type



Pedestal Type
30" Diam. Screen

Jones & Lamson Machine Company
512 Clinton Street, Dept. 710
Springfield, Vermont, U. S. A.
Please send Comparator Catalog No. 402.

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____

P/S A complete line of STANDARD CHARTS and FIXTURES is maintained by us.

JONES & LAMSON J&L *Machine Tool Craftsmen Since 1835*

JONES & LAMSON MACHINE COMPANY
512 Clinton St., Springfield, Vt., U.S.A.

COMPARATOR DIV.
Dept. 710

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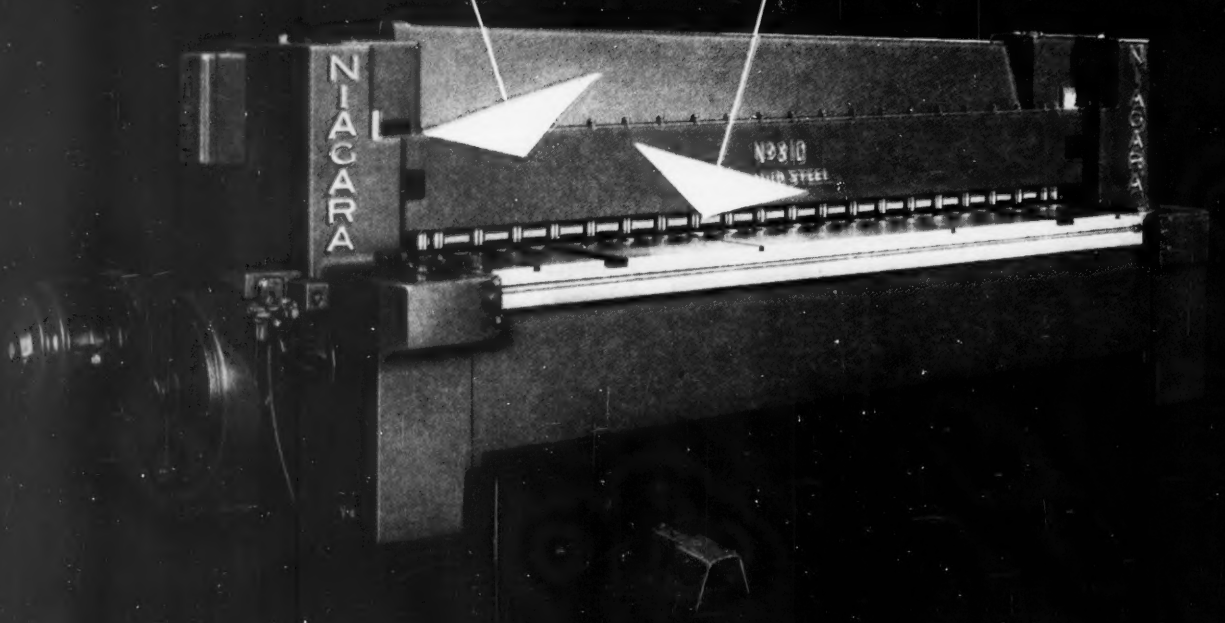
SELF-COMPENSATING HOLDDOWN



NIAGARA MACHINE & TOOL WORKS 1879 75 1954

America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work

a BIG FACTOR in the superiority of Niagara Shears

"STRAIGHT-EDGE" CUTTING ACCURACY
Positive, power actuation grips work securely for maximum cutting accuracy.

LOW IMPACT AVERTS DAMAGE AND INACCURACY
Individual pressure feet contact work with low impact, thus safeguarding both the material and bed against damage, as well as reducing noise level. No hammer-blows to mar work. No peening of bed with resulting distortion of knife seat.

SIMPLIFIED, LOW UPKEEP DESIGN
Simplicity of design and construction, involving a minimum number of parts, assures negligible servicing. With *less* to go wrong, there is *less* to repair and replace.

HOLDS WORK FLAT AND STATIONARY
Multiple pressure feet on 6″ centers, applying uniform pressure, hold work flat and tight against bed to assure utmost shearing accuracy. No rippling of sheet between feet as cut progresses. Firm grip on short pieces.

HANDLES STOCK OF VARYING THICKNESS
Individual feet are self-compensating, requiring no adjustment for cutting stock of different thicknesses . . . *even at the same time.*

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

DISTRICT OFFICES: Detroit • Cleveland • New York • Philadelphia

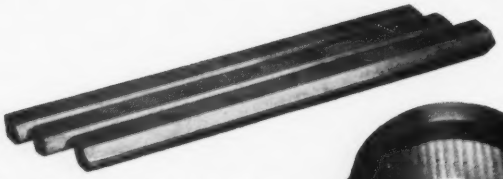
Dealers in principal U. S. cities and major foreign countries

In a power squaring shear, no *single* feature nor component can be fully responsible for accuracy, speed and economy. *They* result from a *combination* of features such as the self-compensating holddown; rigid, fully closed box section construction of bed and crosshead; low slope of upper knife; ample and accurately held crosshead guides; multiple point sleeve clutch —the very features that have established the marked superiority of Niagara's Underdrive Series.

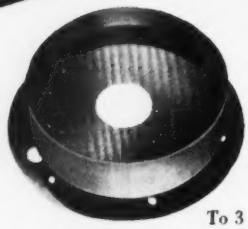
For the whole story, straightforwardly presented, on America's most complete line of underdrive power squaring shears, with capacities from shim stock to 1 in. thick mild steel (lengths 3 to 20 ft.), request *Niagara Bulletin 69*. Write today.

NIAGARA

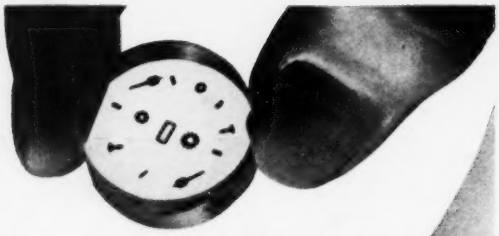
UNDERDRIVE SQUARING SHEARS



Hardened steel machine tool ways, 2½" x 3½" x 50", ground on 6 sides, flat within .001" with surface finish of 5 micro-inches—*5 times faster than other methods!*

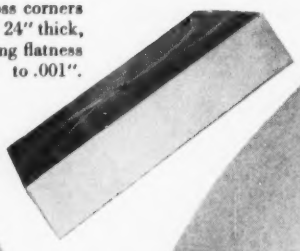


To 3 micro-inches and flat within *one* light band.

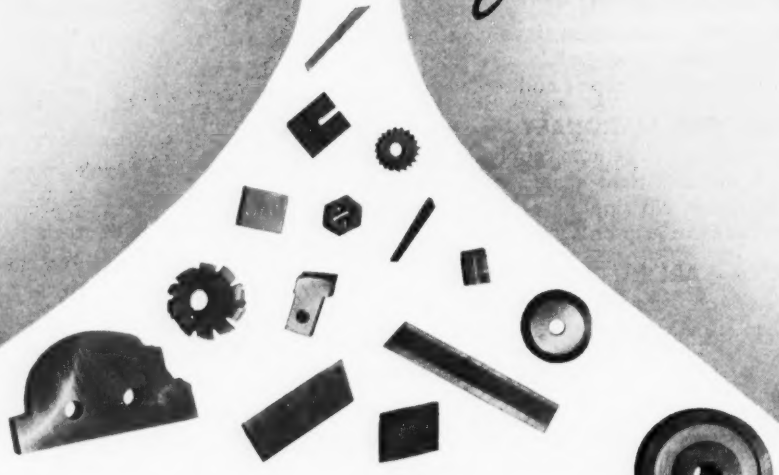


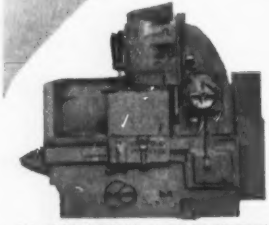
Tiny watch gears, pinions and ruby bearings—flat and parallel—to a dimension tolerance of .0002".

Die plates, 84" across corners and perhaps 24" thick, holding flatness to .001".



"Specs" like these call for Blanchard





NO. 18 BLANCHARD SURFACE GRINDER

Every day, parts like these are ground accurately and rapidly on Blanchard Surface Grinders equipped with Blanchard Abrasive Wheels. They're ground economically too—at costs which help you set competitive prices.

Send a sample of your parts for free test grinding and recommendations.

Send for your free copies of "Work Done on the Blanchard", fourth edition, and "The Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

For more information on products advertised, use Inquiry Card, page 247

YES, THAT'S A TWIST DRILL

A few minutes ago it was a bar of high grade tool steel equal to that used in any drill to be found. Now this steel is being *further* refined and toughened by hammer forging, the process universally used by the makers of high quality tool steels.

All GTD-AMPCO drills over 1" are hammer forged before twisting. And the flutes are polished, too.

AMPCO TWIST DRILL DIVISION

GREENFIELD TAP AND DIE CORPORATION

GREENFIELD, MASS.

No. 2 INDICATOR
(2¼" DIAMETER)
No. 1 INDICATOR
(1¾" DIAMETER)
MIDGET
(1⅛"
DIAMETER)
Now...AT YOUR COMMAND
A FULL RANGE OF Dializers®
PATENTED
Dializer
instantly converts any AGD Adjustable Limit Snap Gage Frame (and "Standard" Frames larger than AGD) to DIAL Snap Gages
Conversion is simply a matter of removing a pair of pins from the Snap Gage and inserting Dializer. Range of adjustment remains the same as before conversion.
You, too, can convert ALL your AGD Adjustable Limit Snap Gages to Dial Reading Instruments Economically
ENTHUSIASTIC USERS, impressed with Dializer performance and adaptability, have insisted that we broaden the range of this practical device. In response, we now make available Dializers with a range of indicators from 1⅛" to 2¼" diameter, graduations of .001", .0001", .0005" and .00025", and a wide variety of dial markings, including metric models.
Get acquainted with this economical, easy way of making your Snap Gages more functional, more valuable, more productive . . . at little cost. Write for details.
STANDARD
Gage Co., Inc.
Poughkeepsie, N.Y.

For more information on products advertised, use Inquiry Card, page 247

A systematic replacement program is a cornerstone at Textile Machine Works

TEXTILE MACHINE WORKS, with four major product divisions, manufacturers full-fashioned knitting machines, braiding machines, wire products, and castings.

It has been the policy of this organization to constantly search for and analyze new machinery, and to purchase the equipment which will serve to make a better product at less cost. Furthermore, the standards of productivity and maintenance of the machinery of the four divisions must be kept at a uniformly high standard.

The MAPI procedure combined with seasoned judgement and common sense serves as a guide in determining the order of precedence in which machine tools should be replaced. Since the major portion of our sales is capital goods, we realize fully the importance of a systematic machine tool replacement program. In fact, we published a brochure shortly after the war entitled, "Good Housekeeping in Business", in which we encouraged the funding and investment of depreciation reserves in new machinery and productive equipment. A systematic machine replacement program is one of the cornerstones of Textile Machine Works' policy to serve our customers the world over with superior quality products at competitive prices.

W. S. SMITH
Director of Equipment
TEXTILE MACHINE WORKS
READING, PENNSYLVANIA

ROCKFORD
INSERT
GROUP

Keep Gathering Metal-Working Production Ideas... Be Well Informed When The Time for Replacement Arrives.....

May, 1954

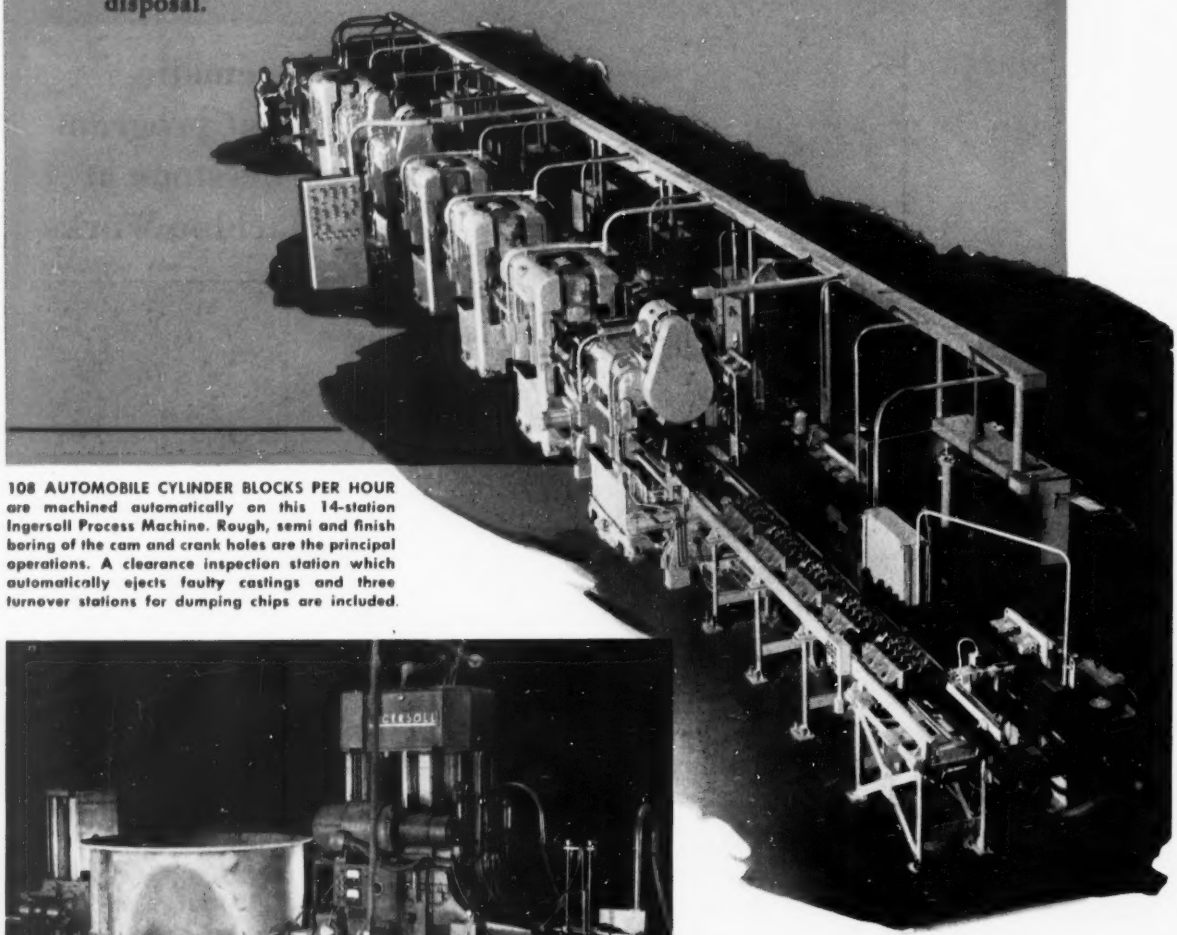
some recent

INGERSOLL

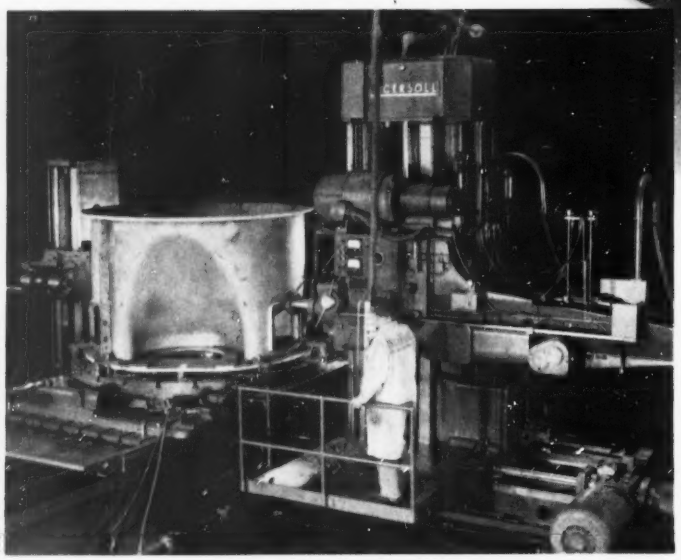
specialized machines...

The six machines shown on these two pages are good examples of the many that we are called upon to build to help our customers meet their individual production needs.

We would welcome an opportunity to place this experience at your disposal.

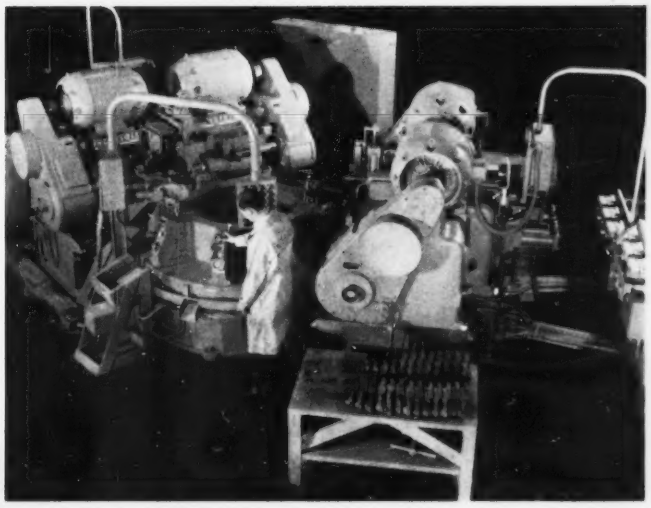


108 AUTOMOBILE CYLINDER BLOCKS PER HOUR are machined automatically on this 14-station Ingersoll Process Machine. Rough, semi and finish boring of the cam and crank holes are the principal operations. A clearance inspection station which automatically ejects faulty castings and three turnover stations for dumping chips are included.

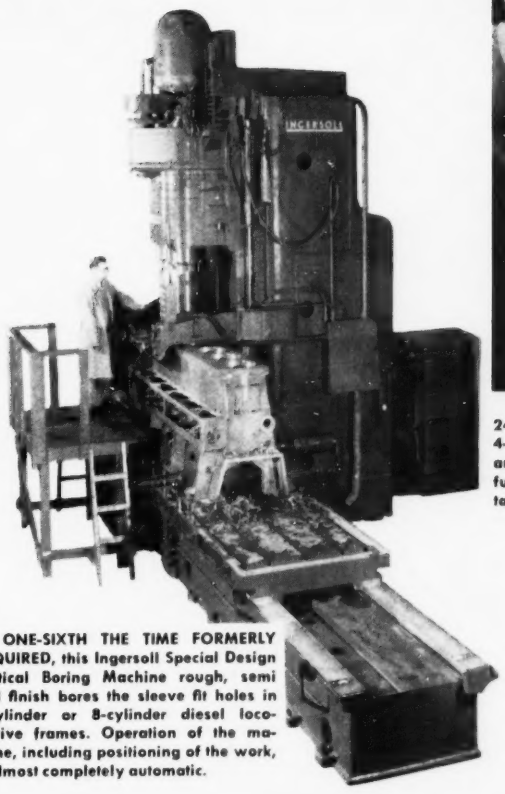


EQUIPPED WITH A RIGHT-ANGLE ATTACHMENT of special design and a rotary indexing table, this Ingersoll 6-inch Bar Openside Milling and Boring Machine cut in half the time required for milling large castings for coal-crushing equipment. Although designed primarily for this job, it also performs effectively on a variety of other work.

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

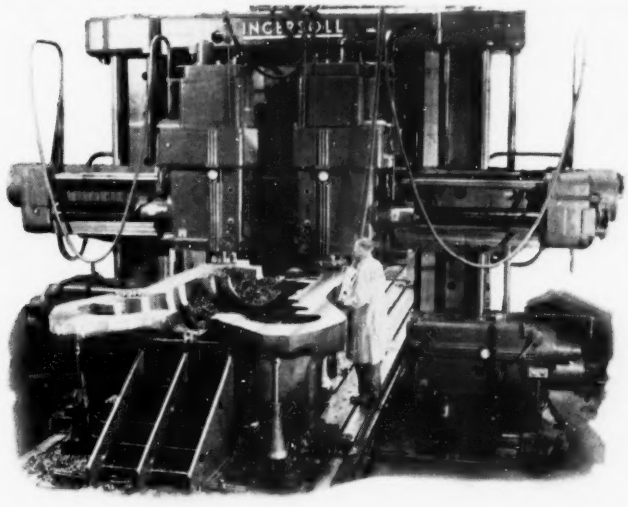


240 CATERPILLAR TRACK LINKS PER HOUR are machined automatically on this 4-Head 4-Spindle Ingersoll Special Design Indexing Machine. Automatic clamping and ejection of the work pieces enables one man to operate two machines. Ingersoll furnished the fixtures and the 14"-diameter carbide Shear Clear Face Mills which take one cut on two edges of the links.



IN ONE-SIXTH THE TIME FORMERLY REQUIRED, this Ingersoll Special Design Vertical Boring Machine rough, semi and finish bores the sleeve fit holes in 6-cylinder or 8-cylinder diesel locomotive frames. Operation of the machine, including positioning of the work, is almost completely automatic.

MILLING 250 AUTOMATIC TRANSMISSION VALVE BODIES PER HOUR, this Ingersoll Special Design Rotary Milling Machine is three times as productive as the machines it replaced. New methods of automatic clamping developed by Ingersoll fixture engineers also resulted in greatly improved accuracy, thus reducing the time required for lapping the contact faces in a later operation.



2½" OF TOUGH STEEL is removed by this 150 HP. Ingersoll Special Design Adjustable Rail Milling Machine in roughing the joint surfaces of high pressure turbine shells. Using special Ingersoll finishing cutters, the same machine produces such a high degree of finish that most of the 90 hours of hand scraping formerly required to obtain steam-tight fits has been eliminated.

THE INGERSOLL MILLING MACHINE COMPANY

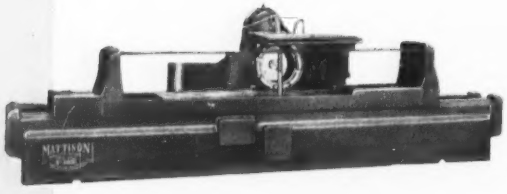
ROCKFORD, ILLINOIS, U.S.A.

BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES

ORIGINATORS OF SHEAR CLEAR CUTTERS

FOR PRODUCTION MACHINE TOOLS IT'S ROCKFORD, ILLINOIS, U.S.A.

Grinding matching surfaces of connecting rods on Mattison 4000 Face Grinder at Caterpillar Tractor Co.



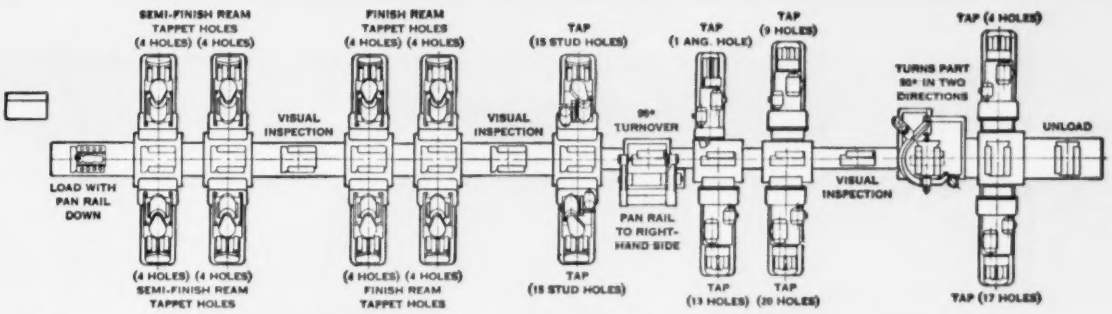
Matching surfaces of connecting rods are accurately ground on a high productive basis on the Mattison No. 4000 Face Grinder. A special hydraulically operated fixture holds rod and cap in position.

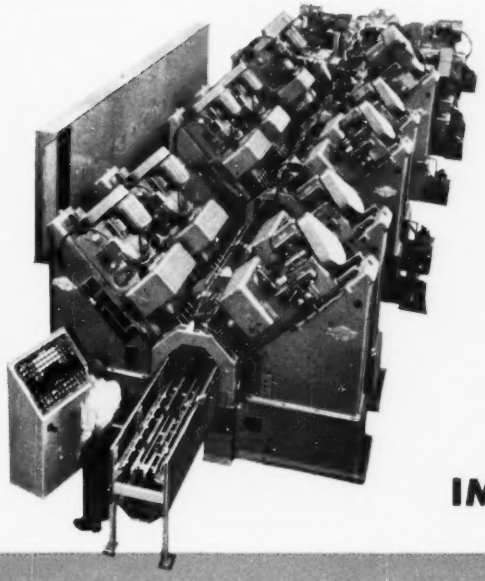
Mattison Face Grinders will handle a wide range of work and are profitably used in virtually all industries — metal working, railroad shops, paper and pulp mills, terra cotta and rubber plants, steel mills and foundries. Ask us for free copy of bulletin 846-2RM for further information on our complete line of Face Grinders.

MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**


SEMI-FINISH REAM TAPPET HOLES (4 HOLES) (4 HOLES)
VISUAL INSPECTION
FINISH REAM TAPPET HOLES (4 HOLES) (4 HOLES)
VISUAL INSPECTION
TAP (15 STUD HOLES)
90° TURNOVER
TAP (1 ANG. HOLE)
TAP (9 HOLES)
TURNS PART 90° IN TWO DIRECTIONS
TAP (4 HOLES)
UNLOAD
LOAD WITH PAN RAIL DOWN
PAN RAIL TO RIGHT-HAND SIDE
VISUAL INSPECTION
(4 HOLES) (4 HOLES) SEMI-FINISH REAM TAPPET HOLES
(4 HOLES) (4 HOLES) FINISH REAM TAPPET HOLES
TAP (15 STUD HOLES)
TAP (13 HOLES)
TAP (20 HOLES)
TAP (17 HOLES)



SOME NEW IDEAS FOR MACHINING AUTOMOBILE V-8 CYLINDER BLOCKS

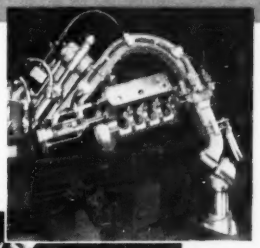
On this new automatic transfer machine — one of the latest in the long series pioneered by Greenlee — automatic handling and repositioning of the block provides some new accomplishments. Two repositioning stations permit the units of the machine to work on the block from *six* different directions. Instead of being slid along the rails, the work is *lifted and carried* between positive locating fixtures at each position.

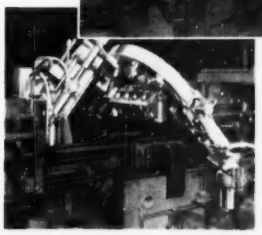
UNIQUE ELEMENTS IMPROVE PERFORMANCE OF

GREENLEE

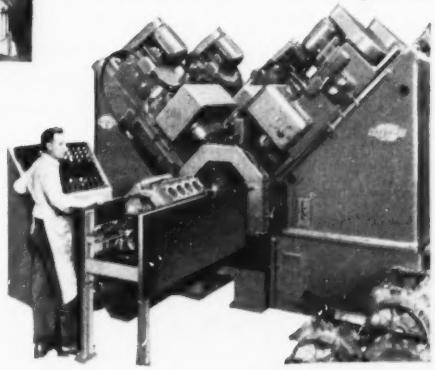
TRANSFER MACHINE

The unusual repositioning unit shown at the left, plus a number of other distinctive Greenlee features, enable the user of this machine to achieve new high standards of quality and production.





Above, two views of the "half-twist" repositioning unit which relocates the block 90° *in two directions simultaneously*, rolling it half over and also turning it from endways to crossways of the machine.



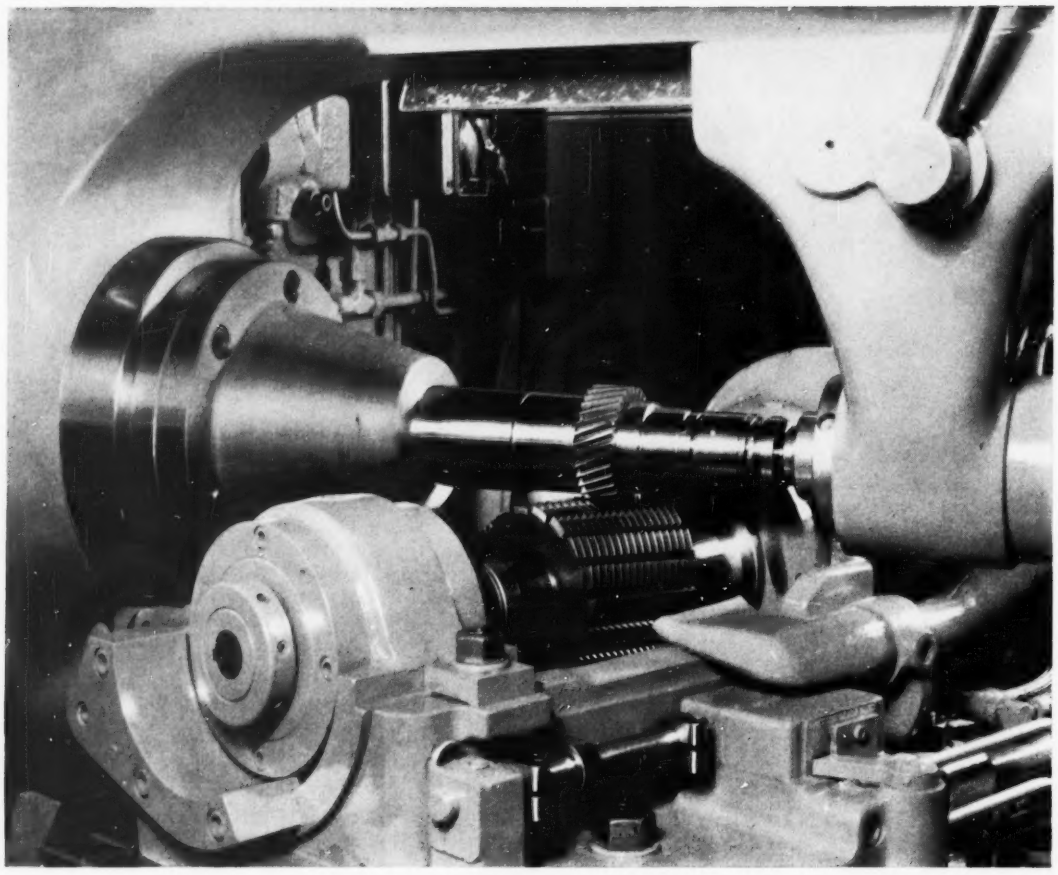
Left, the "front" end of the machine where the partly-finished block is easily rolled into proper position for the transfer bar to lift and carry it automatically into the first machining unit, where it is positively located and clamped for the tool-feed cycle.

GREENLEE

GREENLEE BROS. & CO.
1865 MASON AVENUE
ROCKFORD, ILLINOIS

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**



HIGH-SPEED HOBBING

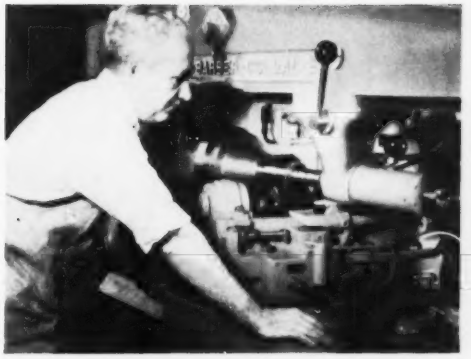
INCREASES PRODUCTION AND TOOL LIFE

The Barber-Colman No. 14-15 Hydraulic Hobbing Machine is being used in several plants for hobbing of steel gears at speeds of approximately 300 SFM with an increase in both production and tool life. Although these speeds have not been considered practical until recently, the size, power and rigidity of the No. 14-15 Machine make it ideal for high-speed hobbing. Even with a standard hob slide, speeds of 300 SFM with a 5″ hob are possible. However, most machines for high-speed hobbing are equipped with a special heavy-duty, high-speed hob swivel.

The high-speed hob swivel is capable of speeds up to 950 RPM and is designed to accommodate hobs up to 7″ diameter. The extra size and weight of this swivel provide the rigidity to maintain accuracy at high speeds. It is equipped with super-precision ball or tapered roller bearings. An automatic hob shifter may be furnished as extra equipment. High-speed hob swivels may be installed on recent machines in the field.

BUILDERS OF PRECISION GEAR

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



The jobs shown here indicate at least 200% increase in production, 100% better tool life, greater profile accuracy and equal or improved surface finish on the hobbed gears, hobbing at speeds of 300 SFM or greater. Using ground and unground hobs, gears were cut from a wide range of steels as high as 207 Br. hardness.

FIRST SERIES OF TESTS

GEAR		STANDARD HOB SWIVEL		HIGH-SPEED HOB SWIVEL		% INCREASE	
DP	No. Teeth	Cutting Time at 135 SFM	Pieces Per Shift	Cutting Time at 326 SFM	Pieces Per Shift	Prod.	Tool Life
6	36 Spur	10.64 min.	72	4.2 min.	161	253%	223%
6	35 Spur	11.62 min.	72	4.5 min.	151	258%	209%
8	55 Helical	15.14 min.	50	6.94 min.	105	218%	210%
8	62 Helical	26.8 min.	28	10.3 min.	72	260%	257%

Double Thread Hob, 5x5x2
Steel — AISI 8620 normalized
Feed — .060"/rev.
No difference in surface quality
Profile and lead angle above average accuracy

SECOND SERIES OF TESTS

HOB	GEAR	SPEED	FEED
Accurate Unground 9 D.P. 3-Thd. 5x5x2	22 Teeth, Helical SAE 5135 170-207 BHN	307 SFM	.045"/rev.
Same	Same	307 SFM	.070"/rev.

Climb Hobbing
Material — AISI 5135
Average lead error—at .070" feed within .0006" in 13 16"
Total Composite Error—.002" both feeds
Estimated Hob Life—200 per sharpening
Using same speed and feeds with conventional hobbing, resulting finish was not as good.

Although high-speed hobbing of steel gears is not used extensively as yet, it is used on enough jobs to prove that it is applicable under the proper conditions. Tests indicate that tool life increases until a speed of 200 SFM is reached, and then drops off rapidly to a speed of 250 SFM. After 250 SFM, however, hob life increases again until it is equivalent or better at 300 SFM than at 200 SFM. Materials on which satisfactory results have been produced include AISI 1113, 8620, 5135 and 4140.

Our Engineers have been working with our customers on high-speed hobbing and have helped to solve many problems. They will be glad to discuss the economy of high-speed hobbing to your specific job if you will submit your part print and production requirements to them.

Call your Barber-Colman representative or write direct to:

HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 625 ROCK STREET, ROCKFORD, ILLINOIS

HOBS AND MACHINES SINCE 1911

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

Where finish and Accurate Size are of Prime Importance...

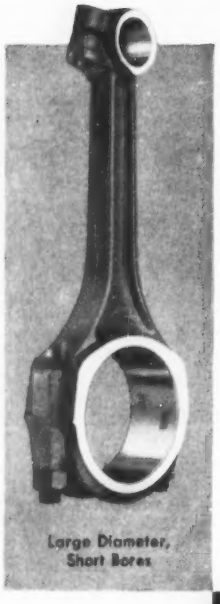
ANY BORE

OPEN END • BLIND END • PORTED • SLOTTED

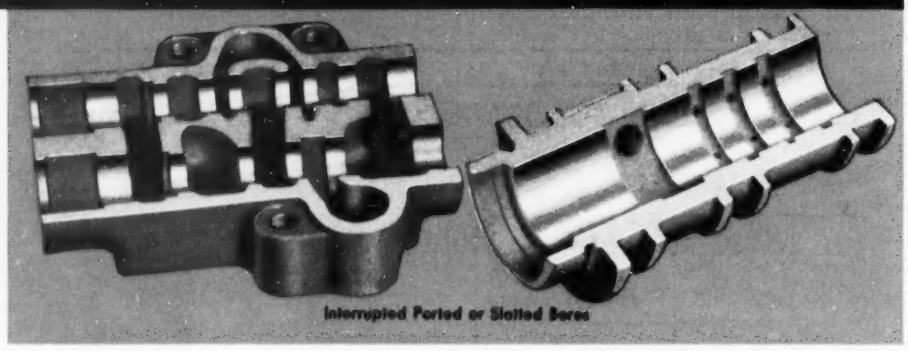
CAN BE HONED WITH

BARNESDRIL

HONING EQUIPMENT!

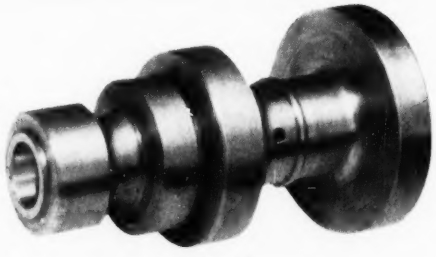


Large Diameter, Short Bores

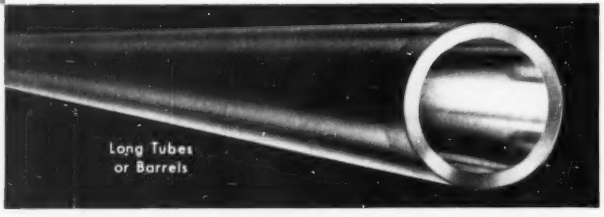


Interrupted Ported or Slotted Bores

Send us specifications, tolerances and production requirements on *any* Hole Finishing Job. BARNESDRIL Engineers will send you equipment recommendations and production analysis without cost or obligation.



Small Diameter, Long Bores



Long Tubes or Barrels

HOLE BARNESDRIL FINISHING

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS

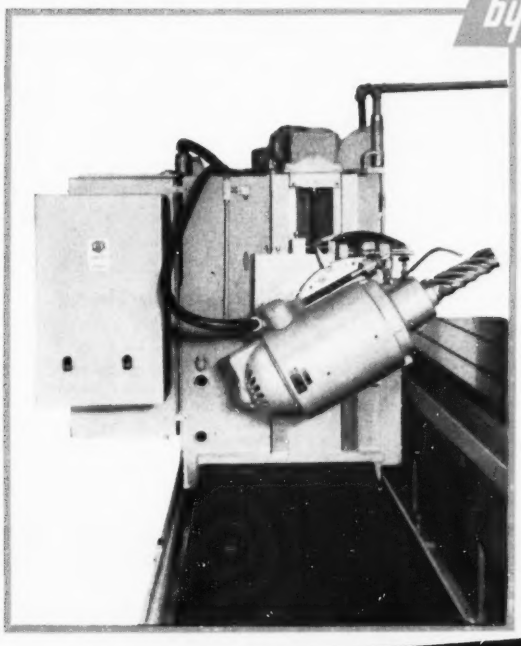
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

ECCO

POWERFUL and VERSATILE!

SCARF AND EDGE MILLING MACHINE

by EKSTROM, CARLSON



Modern manufacturing methods can be well-served by this new open side milling machine with its wide range of adjustments and great metal-removing capacity. It is particularly well adapted to the milling of spars and other aircraft parts, and to the scarfing of solid wing panels commonly used in current aircraft construction. An indication of the machine's potential power is the fact that the cutter spindle (which can be tilted 30° upward or downward) is driven by a 30 h.p. motor. The work table is 12 feet long and the feed rate can be varied between 10″ and 200″ per minute. *Write for further particulars.*

EKSTROM, CARLSON & CO.
Dept. M-4, 1400 Railroad Ave.
Rockford, Illinois

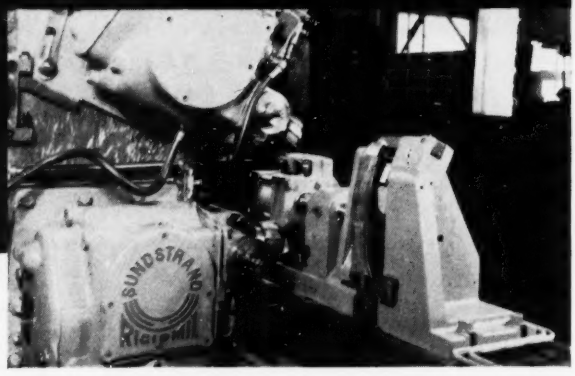
FOR GREATER AIRCRAFT PRODUCTION!

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

HERE'S WHAT CAN BE DONE WITH STANDARD RIGIDMILS...

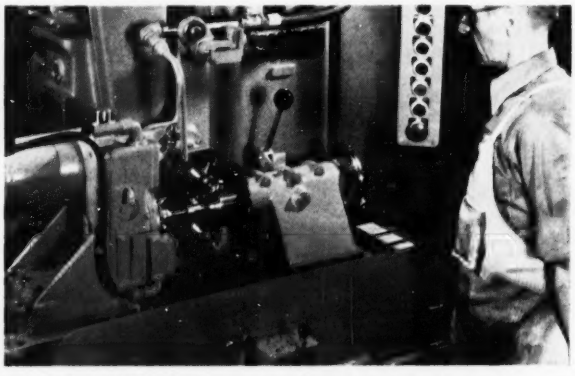
To Solve Special Milling Problems

On standard Sundstrand Rigidmils, the head is a self-contained unit which can easily be replaced with a special head. Consequently, when production or work requirements permit machining several surfaces simultaneously, the standard head can be replaced with a special head, and a *special* job done with the lowest possible capital investment. Furthermore, putting into effect product changes (a difficult problem for many production engineers) doesn't worry anybody in plants where Rigidmils are installed. As these machines can be converted so readily to meet production changes, they represent a combination of maximum production with minimum capital investment. Here are six good examples of standard Rigidmils "engineered" to a production job with "only the head as special".



Vertical and Angular Pads Milled Simultaneously On Rigidmil With Special Head

This standard Sundstrand Model 22 Rigidmil has a special two spindle head for milling two pads on steering gear housing brackets. One head is fixed horizontally and the other has 10 degrees of angular adjustment. The work holding fixture holds one piece at a time and is hydraulically operated. Two pads, one angular and one vertical are milled in one pass of the table at the rate of 100 pieces per hour.



Rigidmil With Special 2-Spindle Head Mills Slots In Pump Rotors

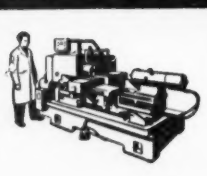
The special 2-spindle head on this standard Rigidmil simultaneously mills 2 vertically opposed slots in pump rotors. The machine handles 3 different sizes of rotors, which are held between centers of the tailstock and special indexing fixture. In an automatic cycle the table rapid approaches, feeds past the upper and lower slotting cutters and reverses for indexing. The action is repeated 6 times to mill the 12 slots in each part.

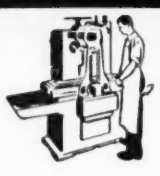
SUNDSTRAND

*"Engineered Production" Service**

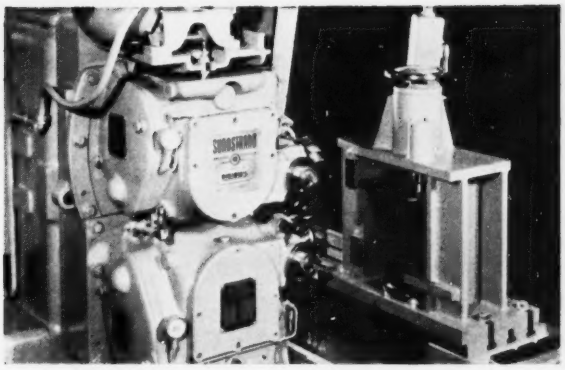
*REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS



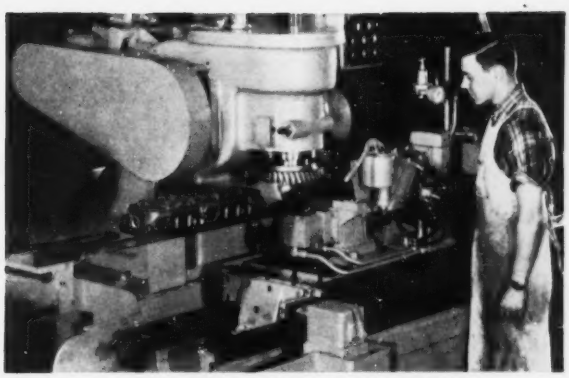


CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**



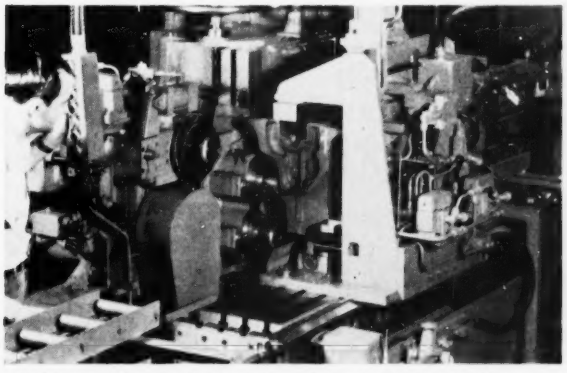
Offset Pads On Bearing Retainers Milled On Rigidmil With Twin Horizontal Spindles

This standard Sundstrand Rigidmil has been provided with two horizontal single spindle heads, one above the other. The two spindles are offset for simultaneously milling a boss and one edge of flange of bearing retainers. A simple, manually operated work holding fixture holds one piece at a time, and an automatic table cycle of rapid approach, feed and rapid return is used to machine the two pads on 60 pieces per hour.



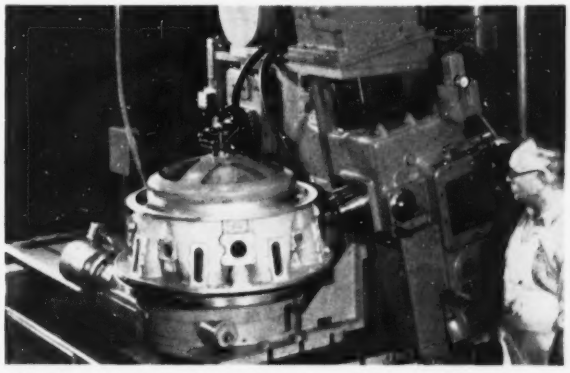
Rigidmil With Vertical and Angular Spindles Mills Combustion Face and Manifold Pad of Cylinder Head

This special head's vertical spindle mills the combustion face and its 25° angular spindle mills the manifold pad. The work is clamped in an air-operated fixture and in automatic cycle is fed at 35 inches per minute past the cutters to remove .015" of stock. At end of feed stroke the fixture automatically unclamps and a hook arrangement pulls the cylinder head out of the fixture as table rapid returns. Production is 60 per hour.



Odd Pads of Cylinder Block Milled On Rigidmil With Special 3 Spindle Head

Here is a standard Rigidmil with a special horizontal three spindle head for face milling two locating bosses and two shoulder bosses on automotive cylinder blocks. The two lower spindles are fixed but upper spindle automatically retracts to clear the rear end of block. The work enters the air-operated fixture from the incoming conveyer, is automatically fed through the cut and advanced clear of the cutters to the outgoing conveyer. Production is 70 blocks per hour.



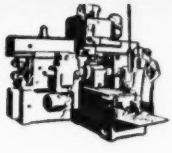
Rigidmil With One Horizontal and One Angular Head Mills 21 Pads on Compressor Frame

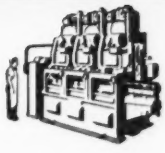
This standard Rigidmil has a single column on which a horizontal and a special angular head are mounted. The angular head mills 8 angular pads and the horizontal head mills 13 pads, all presented to the cutters by a special Sundstrand 21 station index base. In addition to the standard vertical feed attachment, the machine has automatic quill setting to control depth of cut and electronically controlled table and head feeds for infinite variation in a range from 2" to 100" per minute.

Write for more proof of the successful application of Sundstrand "Engineered" milling production. This new 40 page book contains over 35 actual problem solutions together with interesting tooling diagrams. Write for your copy today. Ask for Bulletin No. 643.

FREE DATA

TRIPLEX RIGIDMILS | SPECIAL MACHINES





SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

ANOTHER *American* FIRST ✻

STRADDLE BROACHING ON ROTARY MACHINE MEETS HIGH-SPEED PRODUCTION DEMANDS

1000 connecting rod caps broached per hour —

Continuous, automatic broaching is a necessity on some high production jobs. When required and the nature of the work permits, American engineers develop special, revolutionary machines to solve bottlenecks and reduce metal removal costs to the lowest possible point.

A typical example is this special 36" Rotary Continuous Surface Broaching Machine. It is designed to straddle broach two sides of a connecting rod cap. The production cycle is continuous. The operator manually loads parts into the holding fixture. As the part moves into broaching position it is automatically clamped, broached, unclamped, and ejected into the chute at the bottom of the machine. Operating at 75% efficiency, this American machine is capable of producing 1000 parts per hour. The connecting rod cap is a steel forging.

For practical, high production, low cost solutions to your metal cutting problems see American first. A sample part or detail drawing and mention of your production requirements will receive prompt attention from American.

Write today for American Circular 300 which gives you data on standard American Vertical Hydraulic Surface Broaching Machines.

AMERICAN *American* BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

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American Building - Ann Arbor, Michigan

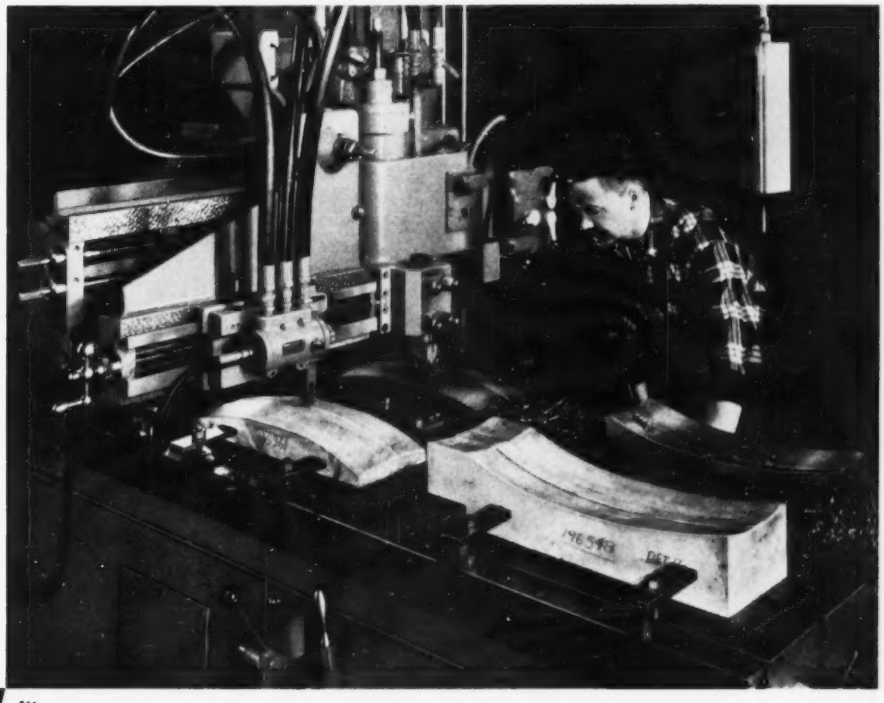
See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

DUPLICATE FORM MACHINING

DIRECT TRANSFER • NO INTERMEDIATE MOTION

with ROCKFORD KOPY-KAT duplicator



Hy-Draulic

535

Inaccuracies are eliminated in duplicate form machining with Rockford Kopy-Kat Duplicators due to the absence of intermediate motion. Here, a Kopy-Kat Duplicator is shown reproducing a three-dimensional form, transferring the form directly to the cutting tool on a Rockford Openside Shaper. The hydraulic duplicator valve is so sensitive, so exact, that positive duplication of complex forms is done with the ease of straight-production machining.

A Rockford Machine Tool Co. Representative will show you how Kopy-Kat duplicating simplifies your form-machining problems. Get the full details from him, with examples on many varied and complex forms and shapes.

ROCKFORD MACHINE TOOL CO.

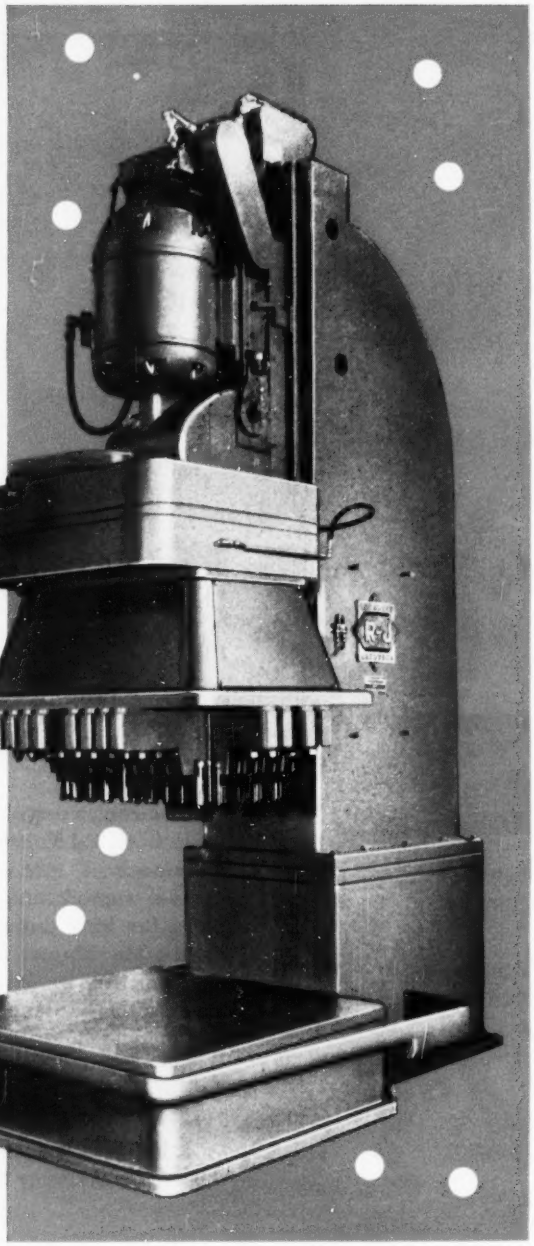
2500 KISHWAUKEE STREET, ROCKFORD, ILLINOIS

FOR PRODUCTION MACHINE TOOLS IT'S ROCKFORD, ILLINOIS, U.S.A.

Rehnberg-Jacobson

GENERAL-PURPOSE MACHINE HAS 24 ADJUSTABLE SPINDLES

Each of the 24 spindles on this machine can be individually positioned, as required, almost anywhere within a work area 22″ deep and 40″ wide. The minimum center-to-center distance is about 2″ and the maximum drill size is ⅝″ when all 24 spindles are in use. Pick-off gears in the No. 70 Self-Contained ALL-MECHANICAL Screw Feed Unit provide feed changes as needed. All spindles run at the same speed, and pick-off gears in the head-drive box provide a range of speed changes.



CAN BE MADE FOR DRILLING OR TAPPING

By means of a few simple changes, in manufacture, the ALL-MECHANICAL Screw Feed Unit can be arranged to drive either drills or taps. The adjustable-spindle feature is available in either case. Fixtures are not supplied, unless specifically ordered, because the machine is intended for general-purpose and limited-production use on a variety of pieces. *Write for further details.*

REHNBERG-JACOBSON MFG. COMPANY

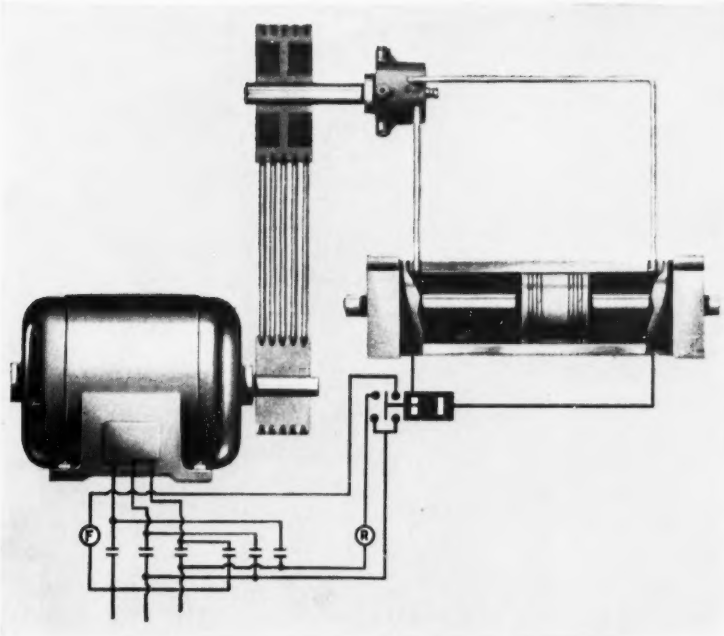
DESIGNERS & BUILDERS OF SPECIAL MACHINERY

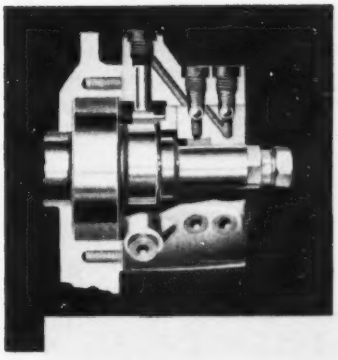
2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

alone

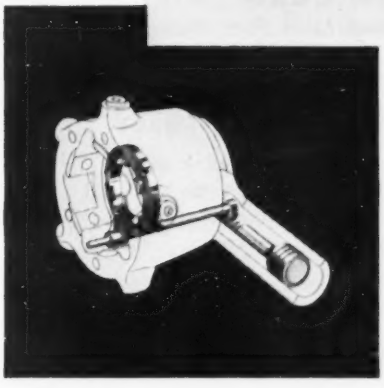
BARNES closed variable flow fluid circuit and controls





Fluid power circuit associated with automatic driving arrangement including a rotary drive shaft; bearings for supporting the drive shaft; a variable flow displacement plunger pump driven by the drive shaft; and an adjustment mechanism associated with the drive shaft including control elements adapted to modulate the fluid flow to an actuator.

Result positive control of the actuator speed, gaged control of change in actuator speed, and a specific and predetermined amount of travel of the actuator for each revolution of the pump drive shaft irrespective of the amount of resistance encountered by the actuator.



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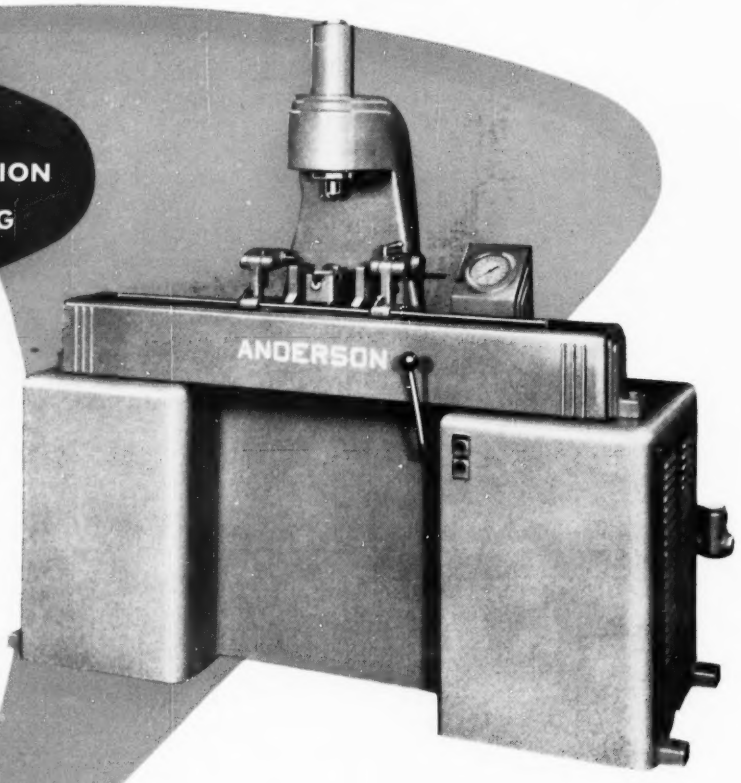
This Anderson

HYDRAULIC POWER PRESS

★ **Checks and Bends in the Same Position**

★ **Is Sensitive Enough to Bend Shafts .001 of an Inch**

PROFIT FROM LOW-COST, HIGH-PRODUCTION *Precision* STRAIGHTENING



Anderson modern high-speed power presses are used for straightening, checking, testing, stamping, numbering, riveting, and other like operations. Both stationary and traveling ram models of presses are extremely flexible and quickly and accurately controlled by a unique rotary control valve. An easily read pressure gauge, indicating ram loading, is conveniently mounted near the work, increasing production and assuring precision. The hydraulic unit is push-button controlled for efficient operation.

ENGINEERING ASSISTANCE

Send us prints of your work and details of your operation. We will gladly make recommendations. No charge . . no obligation.

STATIONARY RAM TYPE

10 OR 25 TON CAPACITY...

The Anderson Press illustrated above is the Stationary Ram type. The length of the work table is 60 inches. Floor space required 26″ x 75″, weight 2100 pounds. This press and the Anderson Traveling Ram Presses can be equipped with checking rolls, spring loaded centers, adjustable anvils, and indicators. To speed production, adjustable stop collars may be used to limit the stroke of the ram. Hand-operated control equipment is standard, but extra provision can be made for foot operation where needed. Write today for Anderson's New Bulletin on Power Presses.

Anderson

ANDERSON BROS. MFG. CO.

1907 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Efficient Stripping of Painting Rejects

When the volume of painting rejects slows down your rate of production—as may occur in the manufacture of rigorously-inspected defense equipment—it is time to plan an efficient method for stripping the faulty coatings.

The rejected parts represent a considerable investment in the cost of metal and the cost of fabrication. To hide 5% of your total production in a corner is like hiding 5% of your working capital in a sock. The quicker you reclaim those rejects and push them through as accepted parts, the better profit you make on your contract.

Sometimes the time element dictates more efficient stripping. Suppose that a sub-contractor undertakes to produce 100,000 parts in 20 days. Suppose also that he averages 5% rejects and that he lets them pile up until he has 5,000 to strip and re-process on the 20th day.

On that day he discovers with sorrow that it is a lot harder to strip and repaint 5,000 rejected parts than it was to paint his regular daily quota of 5,000 new parts. He misses his deadline and suffers embarrassment that could have been avoided by stripping 250 rejects each day for 20 days instead of 5,000 in one day.

Don't Take Off Tomorrow What You Can Strip Today

Furthermore, it usually is much easier to strip the parts on the day they are rejected. Even though the parts were thoroughly baked in the ovens, it is still true that the longer the paint ages on the metal the harder it is to remove by any method of stripping.

Another point is that the easy method of dumping the rejects into an out-of-the-way tank for overnight soaking frequently is not the best way to strip the paint. Some paints cannot be removed by immersion in any one stripper, be it alkaline or acid or solvent. Yet many such paints respond quite readily to the right combination of two of these strippers.

Rinse Wisely

The technique of rinsing is also important. Some paints yield only to a hot alkaline stripper followed by a hot rinse. Sometimes a cold rinse following a hot immersion seems to provide a shock that removes the paint with great speed.

The economy of finding the best stripping method is so great that it merits careful planning. It may also require the advice of a man who has had plenty of experience with all types of stripping operations. Such a man is the Oakite Technical Service Representative in your city.

At the command of the Oakite Representative are more than a dozen stripping materials that reclaim rejects with great speed and effectively strip conveyor chains, racks and hooks. These materials include:

1. Alkaline strippers that remove many types of paints and are also excellent for "killing" the overspray in water-wash paint booths.
2. Solvent strippers that are especially effective on the newer types of synthetic lacquers.
3. A viscous solvent stripper of special value because it adheres to vertical and inverted surfaces.
4. A solvent stripper and an alkaline stripper especially designed for safe removal of zinc chromate primer from aluminum.
5. An acidic material that strips certain organic finishes and simultaneously removes oil and rust.

For more information, phone your local Oakite Technical Service Representative or mail the coupon at the right.

WHAT'S THE BEST WAY TO STRIP METAL PARTS IN LARGE VOLUME?
See page 9
how to STRIP PAINT
with Oakite Materials & Methods
OAKITE PRODUCTS, INC.

Oakite's FREE booklet on "How to STRIP PAINT" answers many questions that will lead you to better stripping procedures. You'll want to read more about:

- ¶ What's the best way to strip paint from metal parts too large to be soaked in tanks? See Page 3.
- ¶ What's the best way to strip large areas of structural metal where a steam supply is available? See Page 5. Where steam is not available? See Page 7.
- ¶ What are the best ways to prepare stripped surfaces for repainting? See Page 11.
- ¶ What strippers are best for removing oil-base paints? . . . Synthetic enamels, alkali-resistant plastics or resin-based paints? . . . Japans, wrinkle finishes, nitrocellulose lacquers, alkyds, phenolics and ureas? See Page 12.

FREE For a copy of "How to STRIP PAINT", write or send us the coupon.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities of U. S. and Canada

OAKITE PRODUCTS, INC.
26 Rector Street, New York 6, N. Y.

Send me a FREE copy of your booklet "How to STRIP PAINT". Also, give me more information about the following new materials:

- ☐ alkaline strippers
- ☐ solvent strippers
- ☐ acidic cleaners and rust removers
- ☐ viscous solvent stripper
- ☐ stripper for aluminum
- ☐ paint-spray booth materials

*Name*_____

*Company*_____

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Advertisement

CUMBERLAND GROUND BARS

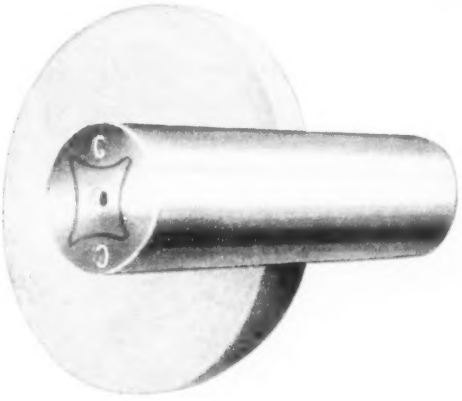
We manufacture 8" diameter, 7-1/2", 7", 6-1/2", 6", and also odd and intermediate sizes down to and including 1-1/8".

ON THE WEST VIRGINIA SHORE, OVERLOOKING THE POTOMAC RIVER, STANDS THE JAMES RUMSEY MONUMENT

The first practical steamboat in the world was run on the Potomac River a few miles below Cumberland, Maryland.

GEORGE WASHINGTON said in his diary, under date of September 6, 1784: "Remained at Bath all day and was shown the Model of a boat constructed by the ingenious Mr. Rumsey, for ascending rapid currents by mechanism; the principles of this were not only shown, and fully explained to me, but to my very great satisfaction, exhibited in practice in private under the injunction of secrecy—."

At a later date GEORGE WASHINGTON said in his diary: "Spent the afternoon with Mr. Rumsey and then Alexander Hamilton and I rode on to Cumberland, Maryland."



Symbol of Quality

Approximately 100 years after the exhibit of this steamboat, Cumberland began grinding bars. They found through experience this was the best method by which accurate steel bars could be produced. These bars are so carefully ground that they are adapted for mass production where gears, pulleys, sprockets and bearings must slide on the bars without delay due to filing or fitting.

IMMEDIATE BARS

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CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U. S. A.
ESTABLISHED 1845 INCORPORATED 1892

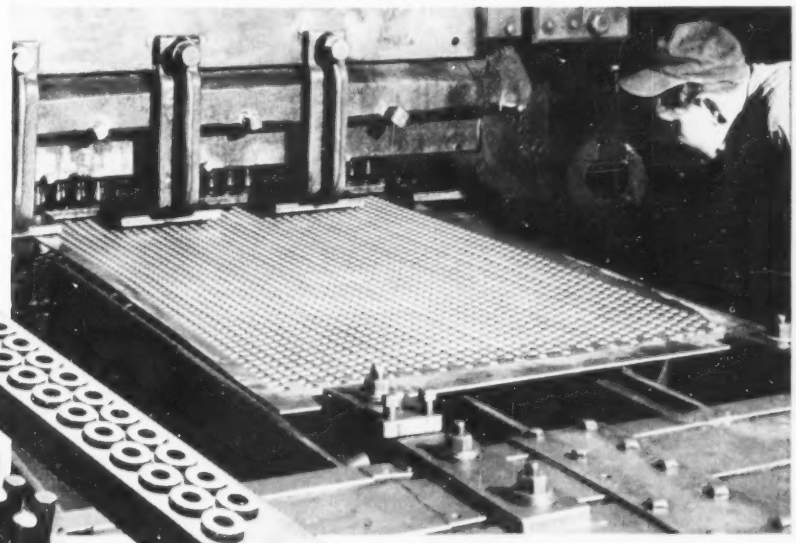
For more information on products advertised, use Inquiry Card, page 247

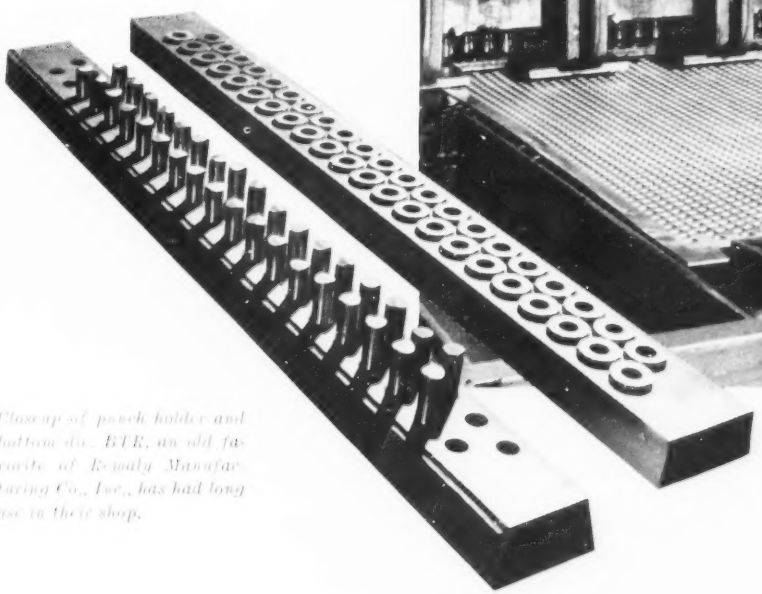
Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BTR Die can simultaneously punch 33 holes 1⅛/16 in. in diameter in ⅜-in. carbon steel plate as it stamps screen segment for coal producers.





Closeup of punch holder and bottom die. BTR, an old favorite of Remaly Manufacturing Co., Inc., has had long use in their shop.

Dies made of BTR take big bites in making screens for coal producer

It's interesting to watch some of the operations performed in the shop of the Remaly Manufacturing Co., Inc., Tampa, Pa. For example, here's a typical job handled by this 90-year-old firm. They rig up a punch holder and dies in a 900-ton press, feed in 6-gage carbon steel plate, or sometimes stainless, or manganese bronze. Then, Boom! Boom! Boom! In less time than it takes to tell, they've punched a large screen segment for use in sizing anthracite coal.

What steel do they use for the dies? It's Bethlehem BTR, an old standby with Remaly. One day we asked them what they liked best about BTR for making screen segments. Wear resistance? Shock resistance? Low distortion? Good machinability? Fast, easy heat treatment?

"It's hard to put a finger on any one of those points and say it's best," answered Bill Yost, one of the heads of the firm. "In our shop, we like BTR on all counts. It stands up well. In fact, I can't remember ever having trouble with it."

BTR (Bethlehem Tool Room) is our general purpose, manganese-chromium-tungsten grade of oil hardening tool steel. Its outstanding characteristic is its safe hardening property. It has the happy combination of abrasion resistance and toughness, making it an ideal steel for tool and die applications where long wear is essential.

Your nearest Bethlehem tool steel distributor has a good stock of BTR on hand and is at your service. Give him a call at your first opportunity.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

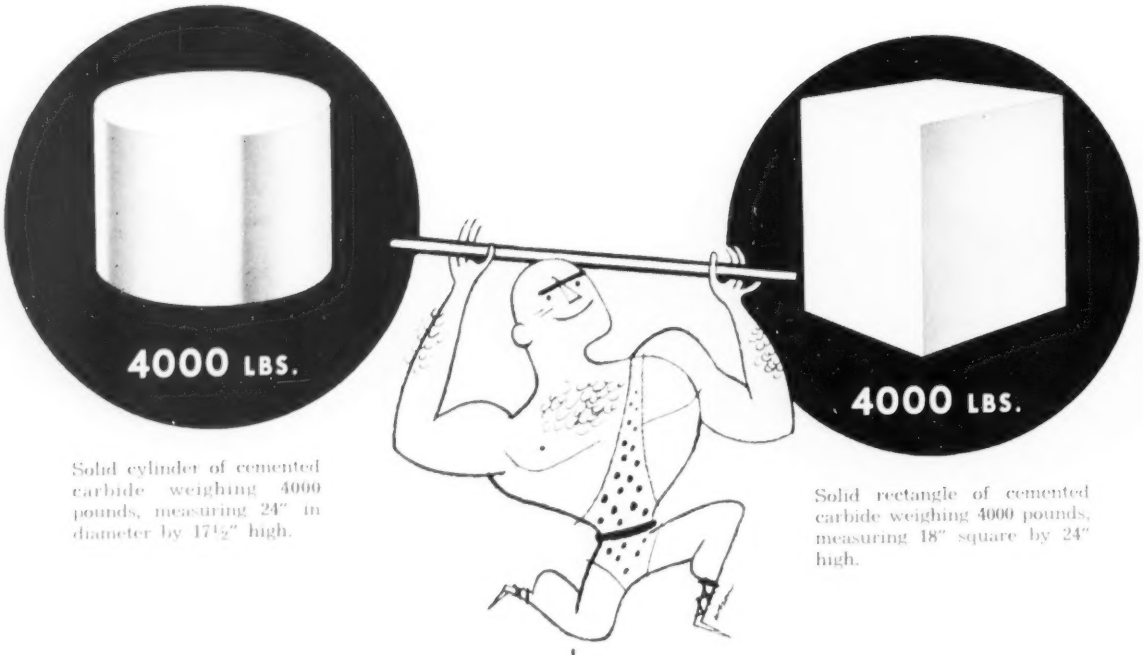
Don't Punch All the Way Through

The tool life of punches can be greatly improved by proper control of the stroke of the punch. It is not necessary for a punch to go completely through the hole being punched, for when it does, rapid wear occurs. The wear increases clearance, which in turn increases the load necessary for punching and also results in burred edges.

When a punch has penetrated part way through the stock, "snapping" occurs and the "button" pops out. How far the punch penetrates before snapping takes place depends upon the material being punched and the thickness of the stock. Generally, the softer the material the greater the penetration required. Conversely, a hard or brittle material requires less penetration.

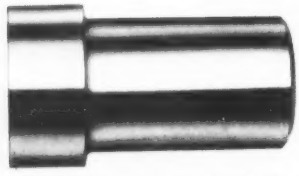
Penetration on soft, thin stock may be as high as 90 pct of the stock thickness, and on hard, thick stock, as low as 40 pct. The less penetration required to bring out the button, the better. What the penetration should be must be determined empirically on each job. Control of punch penetration by adjusting the press stroke means decreased punch wear, better quality parts and increased tool life.

Now... 2-TON pieces



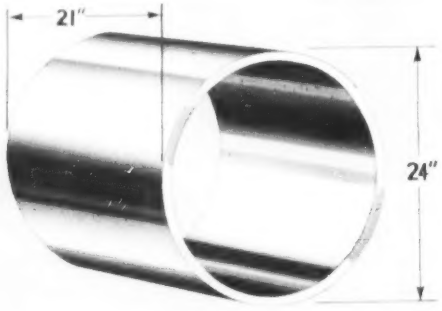
Solid cylinder of cemented carbide weighing 4000 pounds, measuring 24" in diameter by 17½" high.

Solid rectangle of cemented carbide weighing 4000 pounds, measuring 18" square by 24" high.

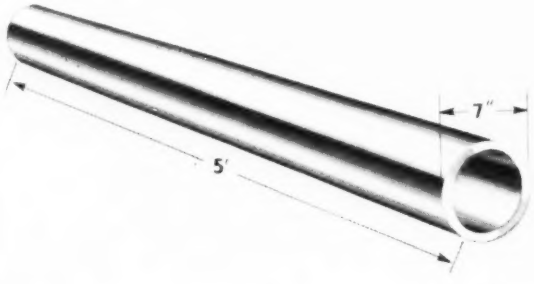


Solid carbide punch used in the cold extrusion of steel.

Ring dies up to 24" I. D. produced one-piece.



Carbide cylinders produced one-piece up to this size.



Carbide cylinders produced one-piece up to this size.

# of Carboloy® cemented carbide

New 220-ton hot press now in operation. Makes carbide pieces in either solid or hollow shapes—in heights up to 5 feet with maximum diameter of 7 inches. Or, in diameters up to 24 inches with maximum height of 21 inches. Up to 4000 pounds in weight. Processing time cut 50% by this method.

Among the many types and shapes the new press can produce are parts for large die sections, rolls for rolling steel strip, punches for cold extrusion work, large linings for brick molds and other parts where the costly factor of wear must be reduced.

Engineers surveying the field. This pressing technique for cemented carbides is so new, applications for it are constantly being developed. Carboloy engineers are helping manufacturers and die makers determine where and how large cemented carbide parts can reduce costs and increase production.

Survey your own plant. Why not survey your own plant for large part applications where wear is a problem. Carboloy engineers can give you specialized assistance. For additional information, please send coupon or write.

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY
11147 E. 8 Mile Blvd., Detroit 32, Michigan

SURVEY COUPON

Gentlemen:

I would like to determine if large pieces of cemented carbide would reduce costs in the following applications:

Please have a Carboloy engineer ☐ call at plant, ☐ call for appointment.

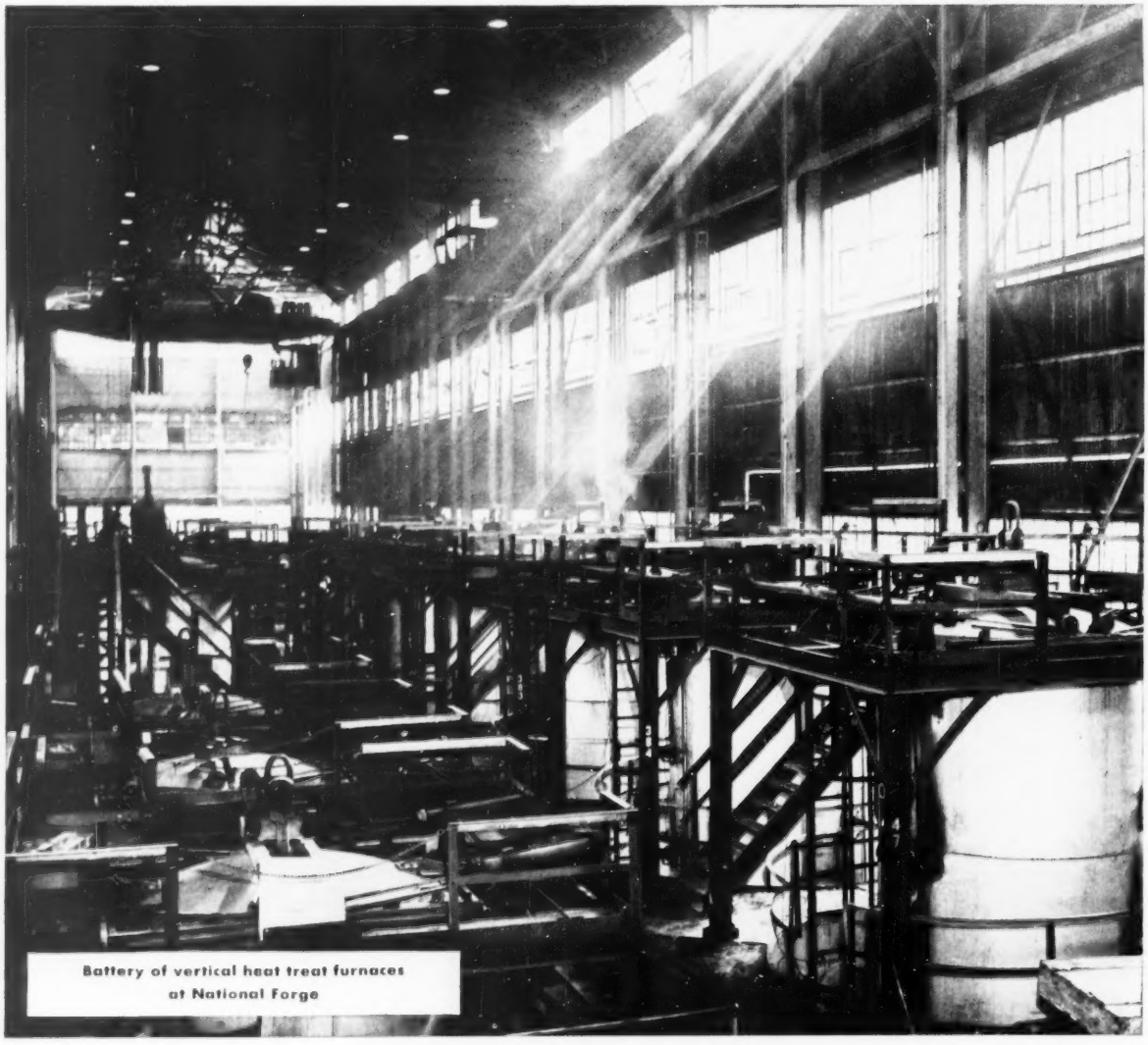
Name Title

Company

Address Zone

City State

Correct Heat Treat Procedure Is Essential to Successful Forgings



Battery of vertical heat treat furnaces at National Forge

National Forge metallurgical department specifies heat treat cycles for your forging based on its analysis, size and shape. The maximum physical characteristics are brought out during this process. That's why it's essential to select just the right cycle and to maintain a continuous check on your forging's progress — National Forge are expert in these procedures.

National Forge heat treating facilities are complete and of large capacity: horizontal annealing furnaces, vertical furnaces (shown in illustration) with capacities for forgings up to 55 feet in length, flame hardening with work capacity of 24 inch diameter x 21 feet long and nitriding furnaces that can accommodate 14 foot long forgings.

When your forgings are National-Forged, you can be sure they're produced with the best equipment handled by experts skilled in each operation from producing the electric steel, forging, heat treating to finish machining...all under one control. For the next forging you need *Try National Forge.* Write:

STEEL MAKERS ☆ FORGESMITHS
HEAT TREATERS ☆ MACHINISTS

National Forge AND ORDNANCE COMPANY
Irvine, Warren County, Pennsylvania

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Order your size of TIMKEN® 52100 steel tubing today—we'll ship from mill stock tomorrow!

101 sizes of Timken® 52100 steel tubing are available in mill stock to take care of your rush hollow parts jobs. Order your size in less-than-mill quantities today, and we'll ship within 24 hours.

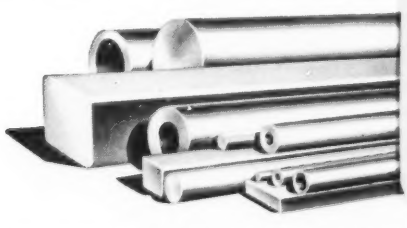
Timken 52100 steel tubing is excellent for most of your high quality hollow parts jobs. It's a through-hardening steel in moderate sections. It can be heat treated to file hardness and tempered back to any desired point. And it can be used in place of more expensive steels.

Available in sizes from 1" to 10½" O.D., Timken 52100 steel is used for hollow parts jobs like these: aircraft parts, ball bearing races, pump parts and plungers, collets, bushings, spindles, grinding machine parts, precision instruments, and dozens of other jobs.

The Timken Company is America's pioneer producer of 52100 tubing. And we're the only company that makes 52100 steel in tubing, bars and wire. Our unequaled experience assures you of uniform quality from tube to tube and heat to heat.

For immediate delivery of your less-than-mill quantity orders, write, wire or phone The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH



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Fine Alloy
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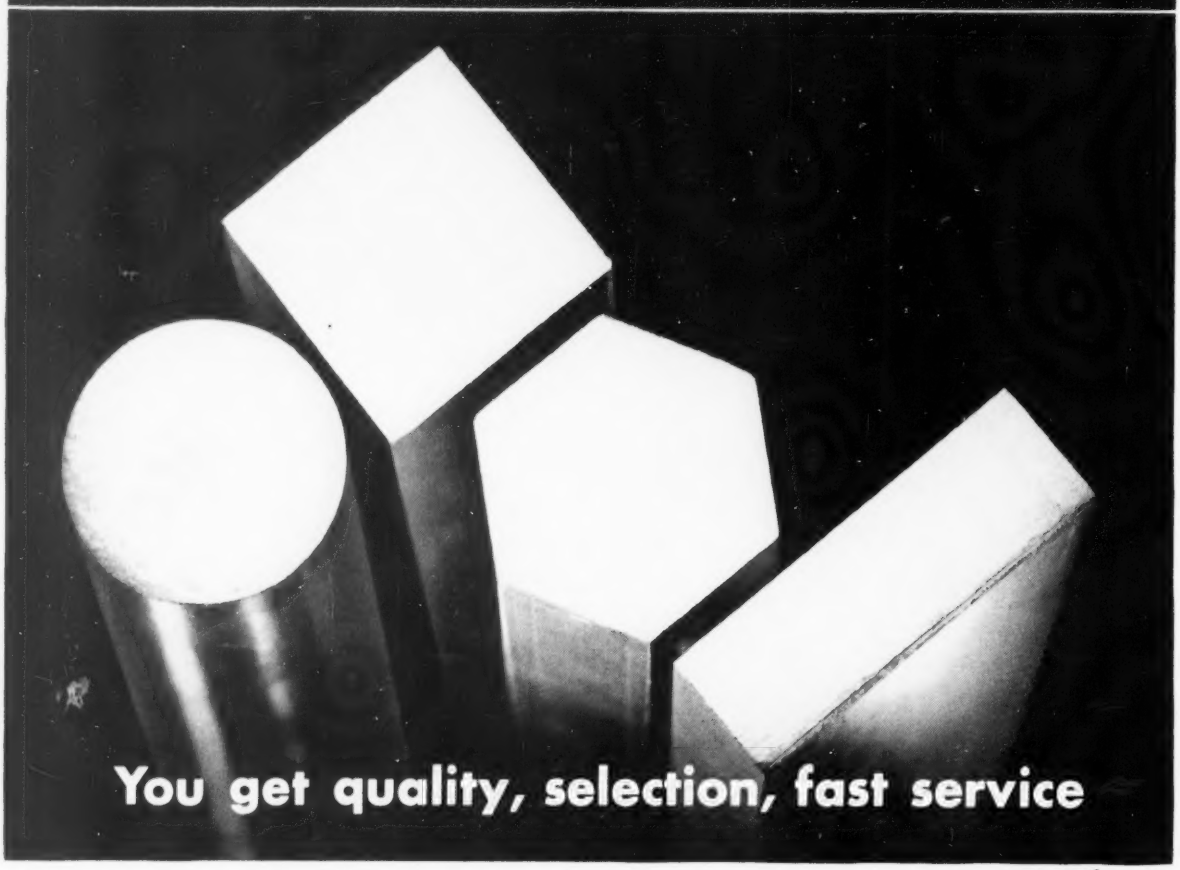
SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

WHY IT PAYS TO BUY COLD FINISHED BARS FROM US



You get quality, selection, fast service

You will save money buying your cold finished bars from U.S. Steel Supply. We carry complete stocks of all the shapes and sizes that are in common demand. All are manufactured from the world's leading quality steel United States Steel. And we will work closely with you to select exactly the right quality for your requirements and the right quality is *not* always the most expensive.

You needn't tie up money and space in large inventories of cold finished bars . . . we can quickly supply whatever you need. Call us for: cold finished rounds, squares, hexagons, flats and precision shafting in all grades; cold finished screw stock, Bessemer rounds, "MX" high speed screw stock.

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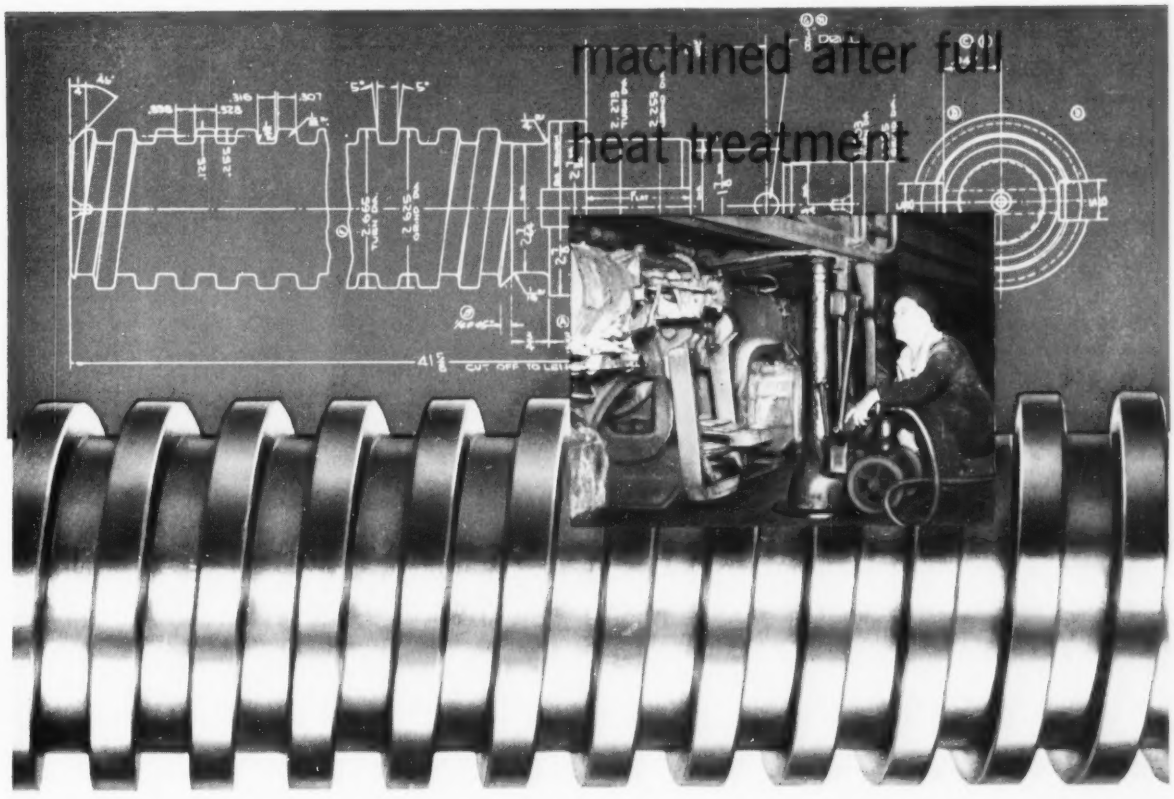
MAX-EL alloy steel part for 100-ton jack machined after full heat treatment



The Max-el part shown above is the lifting screw from a Duff-Norton air motor screw jack. It's the part that actually lifts and holds the load . . . up to 100 tons.

To make the part, blanks are cut from Max-el 3½ bar stock. After heat treating to 321-341 Brinell, threads are chased and all machining performed. Max-el's optimum machinability after heat treatment, its high strength, toughness, deep hardenability — which prevents thread sinkage, and high surface finish make it an ideal choice for this rugged application.

But try Max-el yourself. Its excellent machinability means longer tool life, more pieces per grind. And you'll appreciate its freedom from distortion and superior quality. For immediate delivery of Max-el call your nearest Crucible representative.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **ALLOY STEELS**

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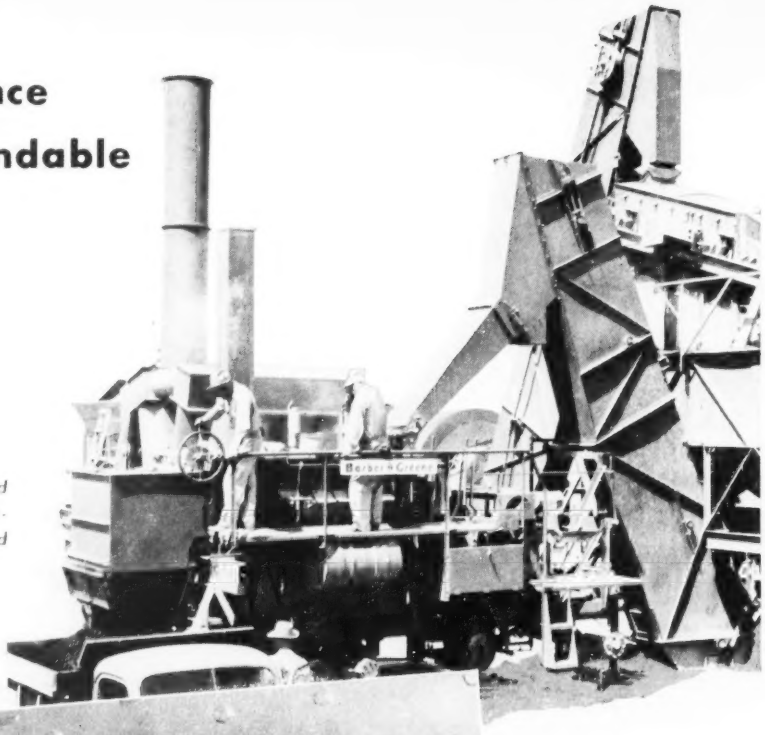
machines of great performance use the most dependable oiling system ever developed



A Model 50 Madison-Kipp Lubricator installed as original equipment on a Model 848 Barber-Greene Asphalt Mixing Plant manufactured by Barber-Greene Co., Aurora, Illinois.

MADISON-KIPP *Fresh Oil*

... by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

There are 6 models to meet almost every installation requirement.

kipp

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203 WAUBESA STREET • MADISON 10, WIS., U.S.A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

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REX

Great works of art clearly show the unique skills of their maker. Even the most careful copy can never truly duplicate the original.

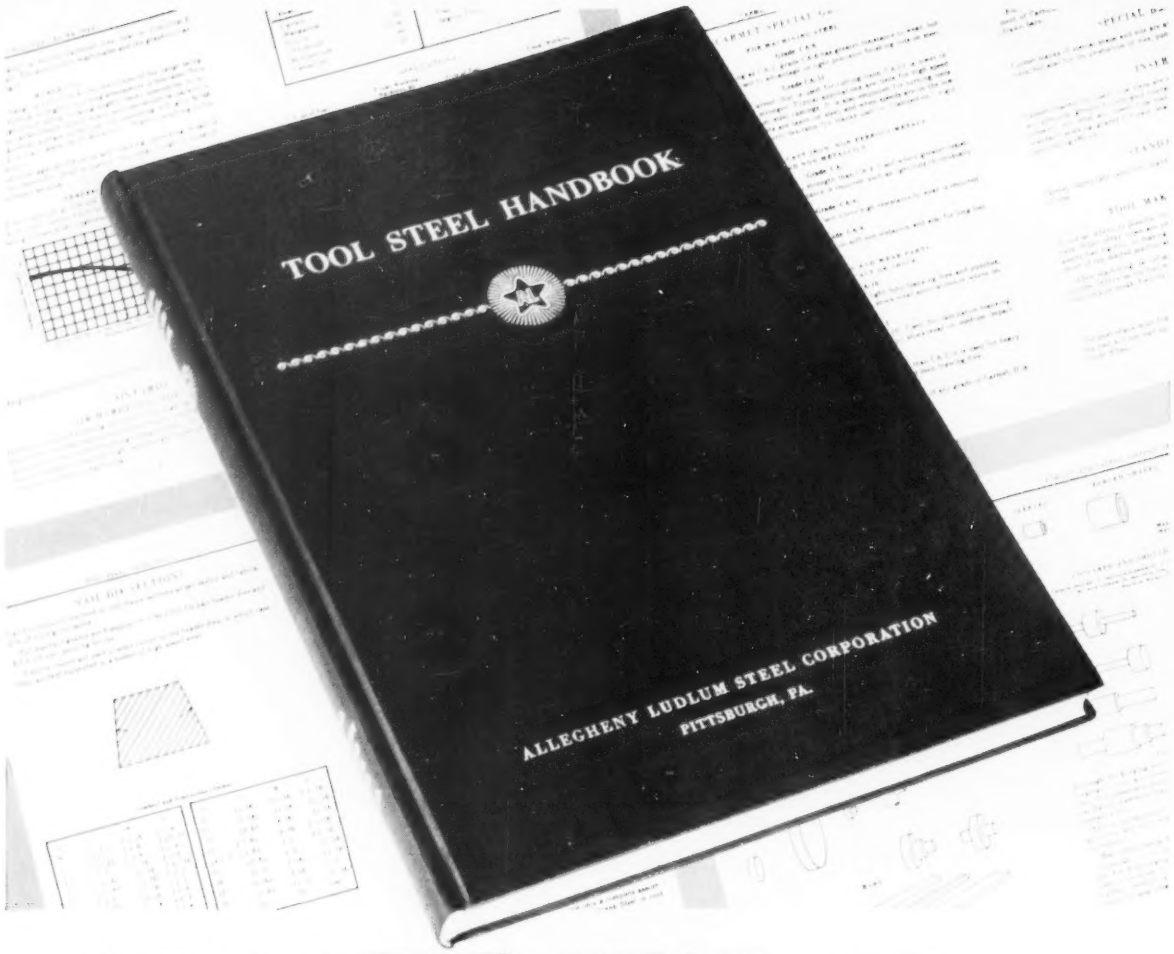
Crucible REX® High Speed Steels are *originals*, too. Ever since 1900, when the Country's leading tool steel specialists combined their knowledge and formed Crucible, we have lavished on tool steel making all the skill and care that goes into any work of art.

That's why REX is the standard of comparison wherever high speed steels are used. But see for yourself. Put REX to work in your shop . . . check its hardenability, response to heat treatment, general quality and fine tool performance. We feel sure that, like thousands of others, you'll come back for more.

Join your Civil Defence Team NOW!

CRUCIBLE

54 years of Fine steelmaking **TOOL STEELS**



AVAILABLE NOW—196 pages of Valuable Tool Steel Information

Another printing of our Tool Steel Handbook—one of the most comprehensive treatises of its kind ever offered by a tool steel producer—is just off the presses. In addition to a relatively complete picture of Allegheny Ludlum Tool Steels, their properties, applications and the forms in which they are available, this 196-page case-bound book presents an extensive discussion of heat treating and handling techniques as well as a complete set of weight tables and other useful reference material.

Your copy of the Tool Steel Handbook will be sent—*without charge*—upon request. Our only stipulation: please make your request upon your company letterhead. ● Write to *Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pennsylvania.*

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Allegheny Ludlum

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FINE TOOL STEELS
SINCE 1854

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2 Stainless Parts...*look alike*

but with 1 of them

A grinding operation is eliminated

Finish and accuracy to size are vital in fabricating this hinge pivot pin. When the Company used ordinary Type 303 Stainless, machined finish was poor and parts had to be ground before delivery. Then they made just one change . . . to Carpenter Stainless No. 8 (Type 303). Now finish is fine, size tolerances so close that final grinding is eliminated.

Part cost reduced 50%

When the change was made to Carpenter No. 8, things started to happen. All troubles previously encountered—including troubles with finish, tools and production, were cleared up. In fact, production has improved to a point that the Company makes an estimated saving of at least 50%. That's a saving worth having—especially when it can be done so easily.

Tool runs between grinds jump 100% to 200%

Before this shop switched to Carpenter Stainless, tools had to be reground every 8 hours or less. Now, they run 18 to 24 hours between grinds. It all adds up to more proof that the difference in stainless steels is Carpenter quality and uniformity. You can see the difference in speed, quality and profit in your own shop—when you specify "Carpenter" on your next stainless order.

Make the <u>one</u> change that counts . . .

change to *Carpenter*

Free-Machining Stainless

take the problems out of production

THE CARPENTER STEEL COMPANY, 105 W. Bern St., Reading, Pa.
Export Department: The Carpenter Steel Co., Port Washington, N.Y.—"CARSTEELCO"

For fast delivery, call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor

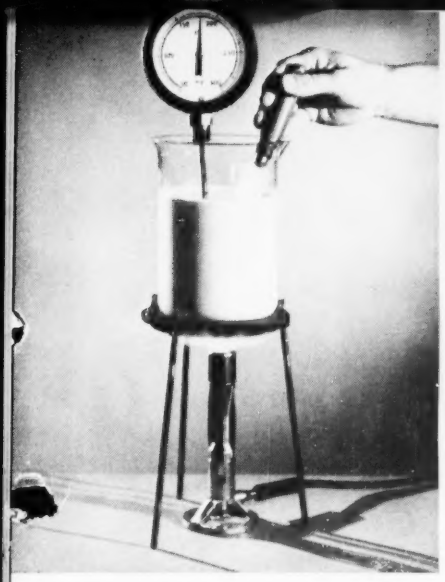
CUTTING. New S.E.C.O. keeps parts and tools cooler. Tools last longer, require fewer grindings; production is increased; finishes are uniformly good.

Now Better Than Ever!

Sunoco Emulsifying Cutting Oil

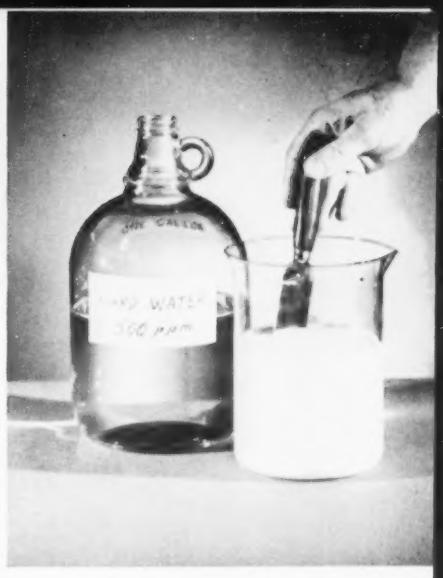
New refining facilities improve industry's most widely used cutting oil and permit it to give these added benefits

- **HIGHER MACHINING EFFICIENCY**—better finishes, longer tool life, increased production in cutting operations
- **INCREASED DETERGENCY**—particularly important in grinding operations—provides better surface finishes, prevents loading and glazing of the wheel, prolongs wheel life
- **BETTER MIXING QUALITIES**—in hot, cold or hard water
- **A PURER, CLEANER CUTTING OIL**—whiter, more stable emulsions; cleaner parts and machines; better operator acceptance
- **EASIER HANDLING**—pumps from storage tanks more readily, flows from drums faster
- **GREATER VERSATILITY**—can be used for rolling, washing and rustproofing as well as cutting and grinding

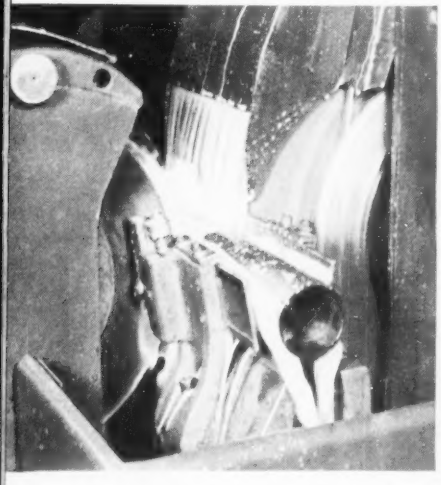


MIXES BETTER IN HOT WATER. New S.E.C.O. mixes and remains stable even at 180 F. This permits its use in washing and rustproofing.

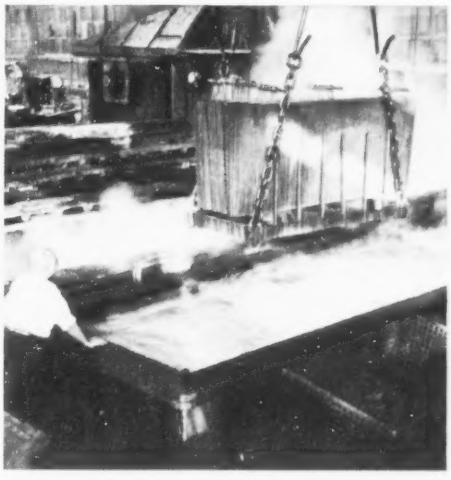
MIXES EASILY IN COLD WATER. New S.E.C.O. forms stable emulsions in the coldest water . . . even ice water does not affect it.



MIXES READILY IN HARD WATER. New S.E.C.O. eliminates the need for special hard-water grades of emulsifying cutting oil.



GRINDING. New S.E.C.O. improves surface finishes because its increased detergency prevents loading and glazing of grinding wheels, prolongs wheel life.



RUSTPROOFING. New S.E.C.O. is a better hot rustproofing medium. It forms stable emulsions, coats metal parts uniformly, protects them against rusting.

WASHING. Because of its increased detergency and its ability to mix and remain stable in hot water, New S.E.C.O. is better for removing grease and dirt from metals.

TEST THIS NEW S.E.C.O. IN YOUR OWN PLANT. For more information, call your nearest Sun office or write SUN OIL COMPANY, Phila. 3, Pa., Dept. M-5.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

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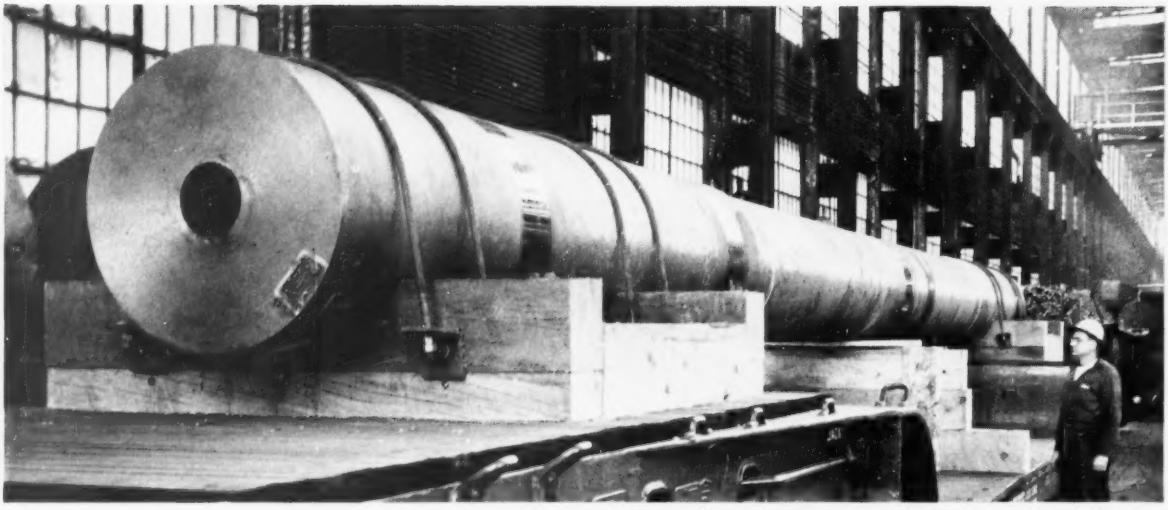
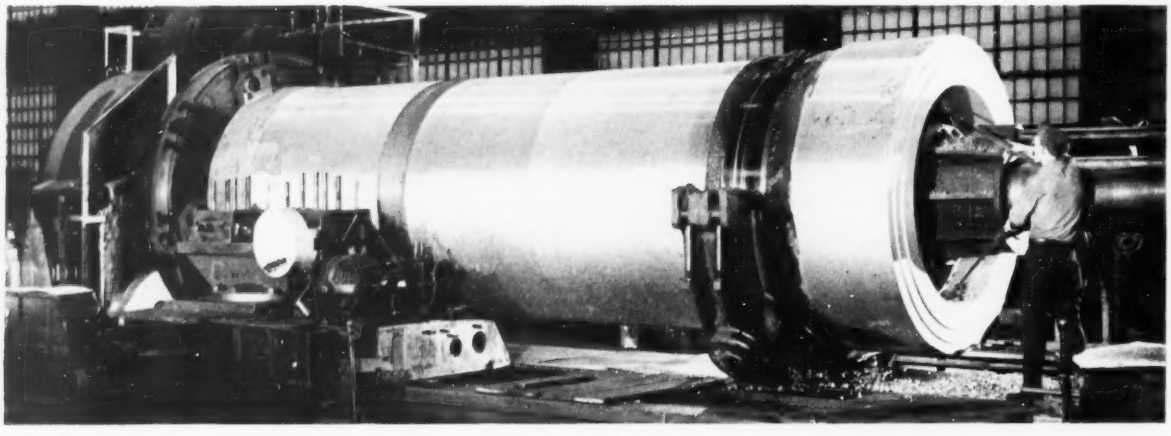
Made by the producers of famous Blue Sunoco Gasoline and Dynalube Motor Oils



Big Parts for Two Big Presses



These forgings couldn't be hidden under anybody's hat; in fact, it would take a good-sized tent to cover them. The long column on the freight car, part of a 35,000-ton forging press, weighs 94 tons. The husky cylinder is for a smaller press, but even so, it will weigh 88 tons after machining and will have an OD of approximately 7 ft at the largest point.

The two forgings are giants by any standards. Bethlehem turns out plenty of big ones—some even larger than these. But don't forget, our shops are always glad to handle the smaller jobs, too—pieces weighing only a few tons, a few pounds, or a few ounces. We mentioned hiding under a hat. A great many Bethlehem forgings could easily be covered by a hat, and not a very large one at that. For instance, we've made millions of small drop forgings and are making more all the time.

The point is, Bethlehem is equipped to produce the *full* range of forgings—everything from the midget class to the heavyweights of 100 tons and more. So don't think of us in terms of any one size-group. Whenever you're planning forgings . . . large, small, or medium . . . phone or write our nearest office. We'll do the job you have in mind and do it right!

On the Small Side

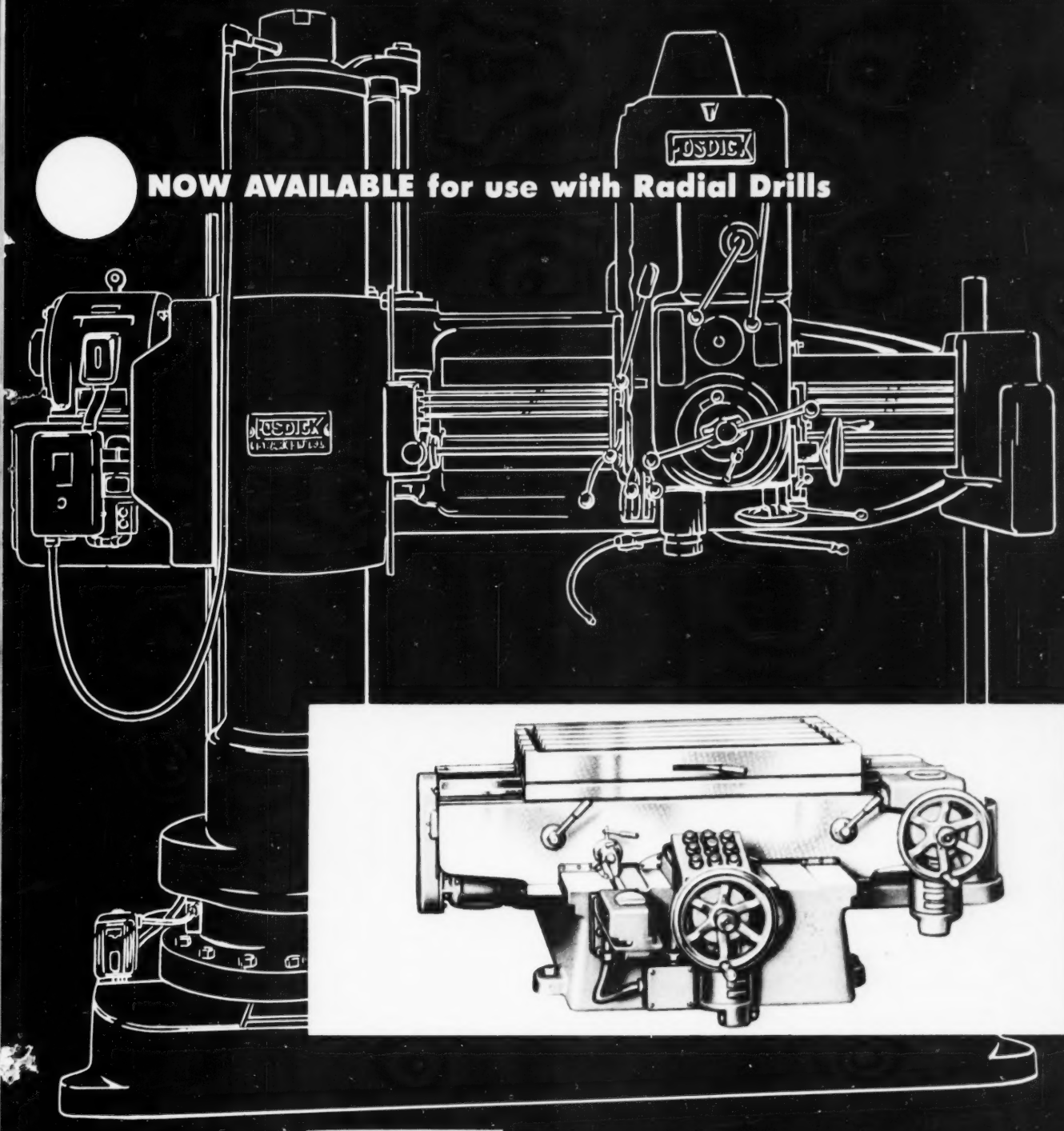
This 1½-lb drop forging is as typical of Bethlehem production as the huge pieces weighing many tons.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

NOW AVAILABLE for use with Radial Drills



FOSDICK AUTOMATIC POSITIONER

— Eliminates costly jigs, stop adjustments—yet has advantages of both.

— Gives exact reproduction of drilled, bored, tapped and reamed parts.

— Automatically positions work to ± .0001".

— Gives rapid PRECISION production, without experienced operators.

FOSDICK AUTOMATIC POSITIONER

The Fosdick Automatic Positioner gives you exact reproduction of precision drilled, bored, tapped and reamed parts – without jigs, without setting stop adjustments. Once two simple duplicating bars are prepared, positioning of work is done automatically at the touch of a button, accurate to ± .0001"!

The two easily-made, easily-stored duplicating bars are your *permanent* record of positions for a particular job. Once a job is run, you store the bars, use them every time you rerun that same job – weeks, months or years later.

Two easily-made, easily-stored duplicating bars control positioning

One bar locates holes lengthwise, the other locates them crosswise. Made of ⅛" bar stock, each duplicating bar is bored to correspond precisely with the position of each hole in the work.

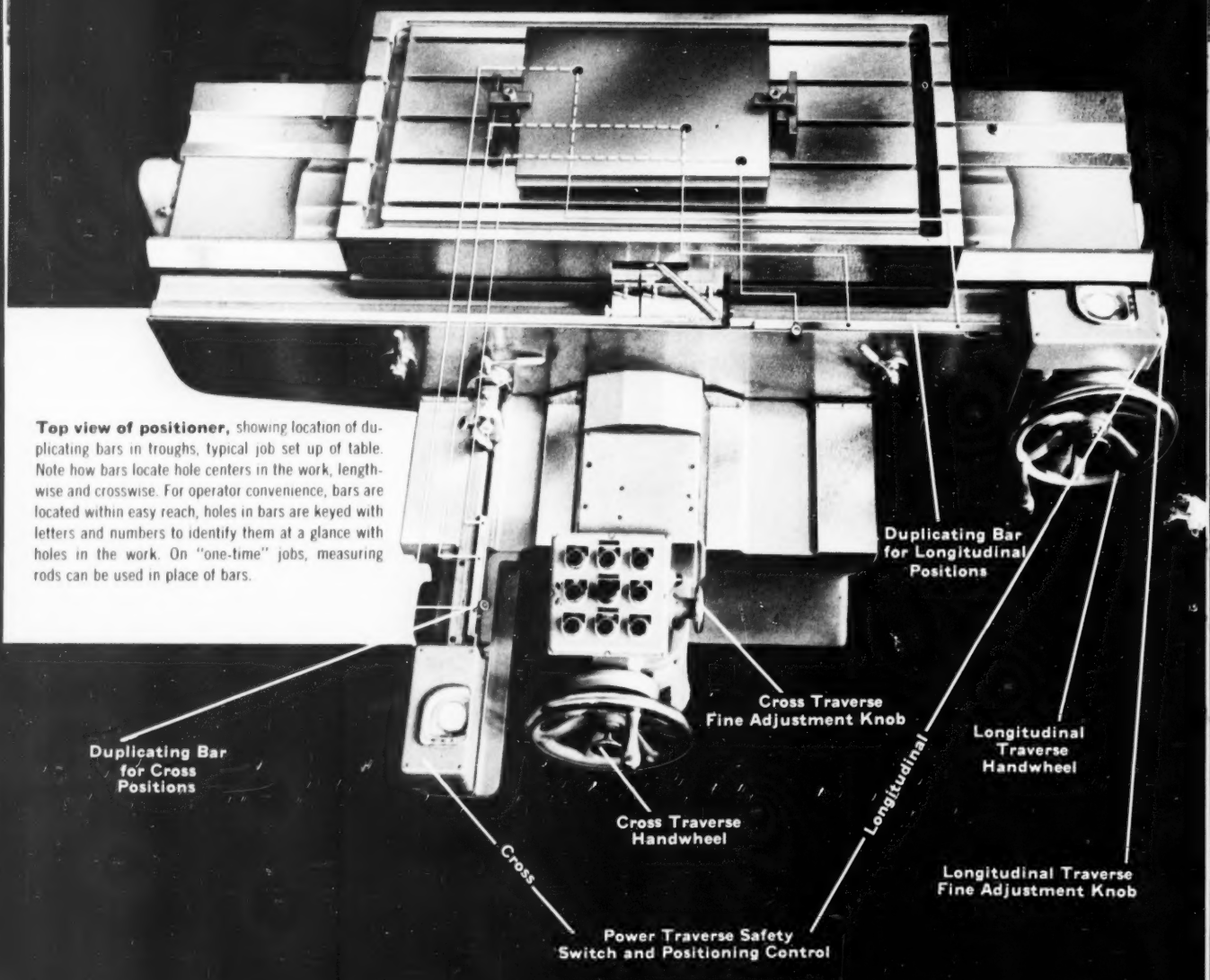
Simple to prepare—Average duplicating bar boring time is four minutes per hole.

Compact—You can store dozens of duplicating bars in the space needed for a single jig!

Permanent—Use them over and over again—weeks, months or years after they are made.

One set-up, any number of holes—Set up virtually any number of positions with one set of duplicating bars. This means even complex jobs with hundreds of holes require only one set-up.

In operation, bars are placed in troughs. Pins—one for each duplicating bar—are inserted in holes in the bars. These pins establish individual lengthwise and crosswise positions. To change positions, operator simply moves pins, presses buttons and table moves to new position.



Top view of positioner, showing location of duplicating bars in troughs, typical job set up of table. Note how bars locate hole centers in the work, lengthwise and crosswise. For operator convenience, bars are located within easy reach, holes in bars are keyed with letters and numbers to identify them at a glance with holes in the work. On "one-time" jobs, measuring rods can be used in place of bars.

now available for use with radial drills

The Fosdick Automatic Positioner has been in use for over four years on Fosdick Jig Borers and Automatic Positioning Machines. It is tried and proven in the field, has boosted production on precision jobs as much as 250%. Now for the first time, Fosdick makes it available as a separate unit.

The Positioner can be quickly installed for use with your existing radial equipment. In your shop it will pay for itself many times over through savings in man-hours, set-up time, materials and storage space.

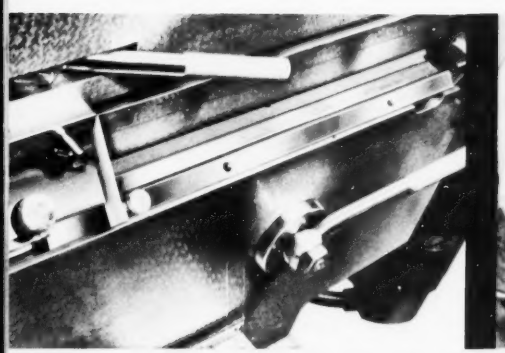
No jigs, no stop adjustments—
bars make permanent record of positions

The Fosdick Automatic Positioner eliminates jigs and all the high costs that go with them—design, materials, fabrication, maintenance, storage. And no stop adjustments to bother with everytime you run a job! The duplicating bars replace both jigs and stop adjustments, make a permanent record of positions.

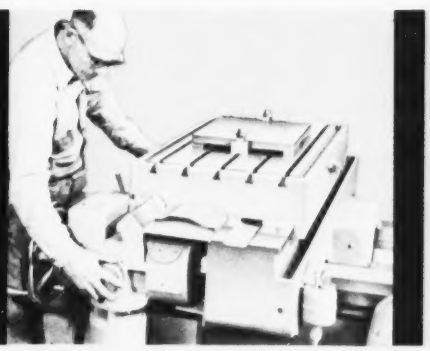
Precision production without an experienced operator

The Fosdick Automatic Positioner positions work to ± .0001". Using it with a good, rigid radial drill, you can hold extremely close tolerances. Once duplicating bars are made, the human element is eliminated. You can get precision, rapid production, without an experienced operator.

How you use the Positioner:

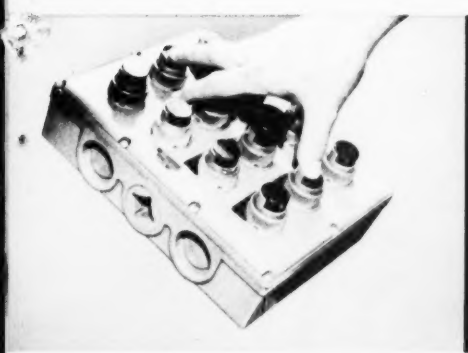


First put duplicating bars in their respective troughs. Place pins in holes that correspond to position of first hole to be drilled in work. Press buttons. Table moves to pin positions so that table and spindle are lined up for first hole.

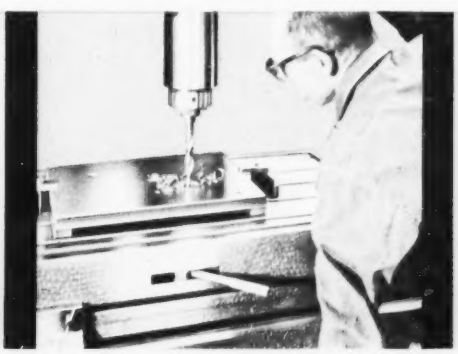


Position work on table so that center of first hole to be drilled lines up with spindle. Operator above is making final adjustment with Longitudinal Traverse Fine Adjustment Knob, to line up work and Positioner exactly with spindle. Another knob controls cross traverse fine adjustment. Drill first hole.

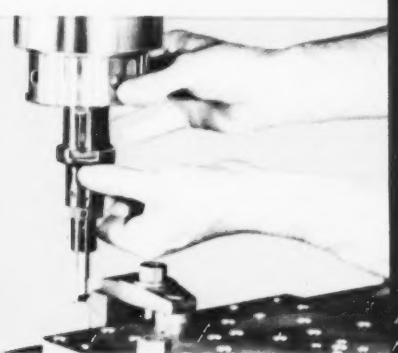
Ready for next hole. Move pins to lettered and numbered duplicating bar holes that correspond to position of next hole in work.



Press buttons: one for crosswise positioning, one for lengthwise positioning. Rapid traverse motor moves table to within 1/16" of final position. Then precision positioning motor automatically takes over, moves table to ± .0001" of final position. The motor then backs off to relieve all pressure between traverse screw and table.



Drill second hole. With all pressure gone, table stays put throughout drilling operation. Repeat this operation for each hole. Move pins, press buttons, drill hole. That's all there is to it! When job is finished, store duplicating bars until ready to run job again.



If you use the Positioner with a Fosdick Economax Radial Drill BF Spindle equipped you can change tools in seconds, while the machine positions. Get tolerances within tenths on hole size, even after dozens of tool changes!

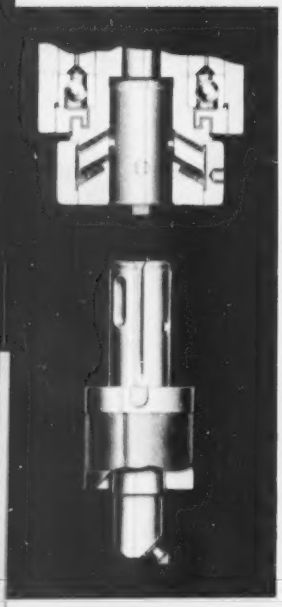
USE THE AUTOMATIC POSITIONER WITH ANY GOOD, RIGID RADIAL

Can be very easily installed for use with your existing radial equipment. Rigidity, true-running spindle are, of course, essential to get fine precision. Because the Positioner moves the work, the radial is used in clamped position with spindle located stationary.

SPECIFICATIONS OF FOSDICK POSITIONER

Table longitudinal travel	power 42", hand 43"
Table cross travel	power 22", hand 23"
Working surface of table	22" x 44"
Top of table to base of radial	31"

Fosdick BF Spindle Gives precision tool changing in seconds!

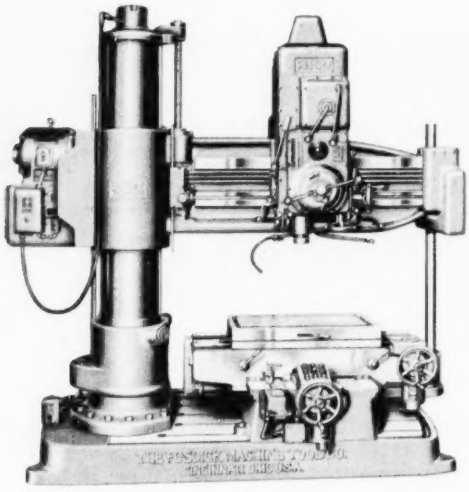


No more "cut and try" resetting of boring tools every time you change. With the BF Spindle (extra equipment) on a Fosdick Radial, you can change tools with such accuracy that hole sizes are repeated within tenths, *without* resetting, *without* jigs. Changing takes less than 10 seconds! You can slash time drastically on production work where repetitive precision is essential.

High-precision tool holder is built right into the spindle of the Radial. Straight-shank tool adapters fit holder precisely—close fit wipes surface clean as adapter is inserted, keeps dust and dirt from upsetting precision fit. Adapters accommodate both standard and special-sized tools.

The Fosdick Economax Radial Drill Hydraulically Controlled Throughout

Rigid, reinforced construction plus ease of operation give you smooth positive action *on any job.* Controls are grouped conveniently around the head for maximum operator efficiency. Outstanding features include:



Patented hydraulic arm and column clamps

Clamping interlocked with controls for ease of operation

Superfinished column for added precision

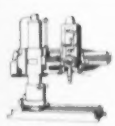
Hydraulic safety nut

36 spindle speeds, 18 feeds

11" to 19" columns, 3' to 8' arms

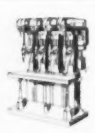
WRITE FOR BULLETIN 37

Need Drilling Equipment? Get a Proposal from Fosdick!

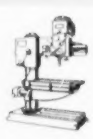


Radial Drills

Jig Borers



Sensitive and Upright Drills



Sensitive Radial Drills

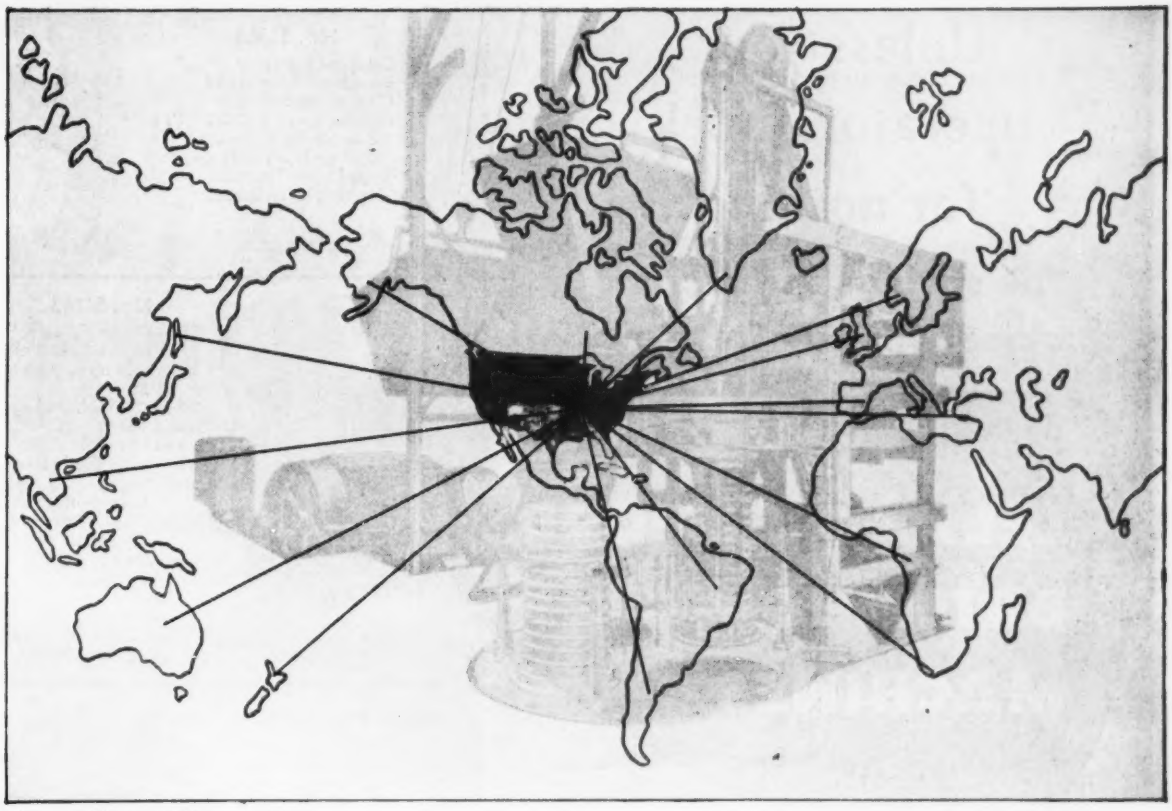
Automatic Positioning Machines

FOSDICK

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

5M-4-54-YK

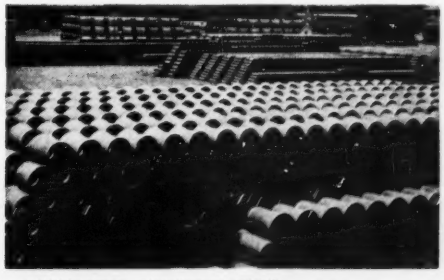
Litho in U. S. A.



From Sioux City, Iowa:

CITIES SERVICE OILS AND GREASES SENT ALL OVER THE WORLD WITH McCRACKEN MACHINES!

"**OUR FINISHED MACHINES** are completely serviced with Pacemaker 2 hydraulic fluid, Optimus 4 oil in the transmission and Trojan M for bearing grease."



CORRUGATED CONCRETE PIPES, used for sewer, culvert and irrigation work, are one of industry's most vital tools. McCracken Machines make the very finest.

ONE CITIES SERVICE PRODUCT SOLD MANUFACTURER ON THE COMPLETE CITIES SERVICE QUALITY LINE!

During the early part of World War II, Concrete Pipe Machinery Co., manufacturers of McCracken Machines, called in a Cities Service Lubrication Engineer for answers to some tough metal-cutting problems. On his recommendation, they tried Cities Service Cutting Oil, Chillo 93. Finished work was so improved and tool life so prolonged, that Concrete Pipe had a complete lubrication survey made of their plant.

THIS CAREFUL SURVEY PROVED THAT THE COMPLETE CITIES SERVICE LINE COULD DO THE BEST JOB FOR THEM. Electric motors, spindles, gear reducers, air compressors . . . drilling, grinding, machining of cast iron parts, threading, tool and die work . . . hydraulic systems, bearings, transmissions . . . Cities Service Industrial Oils, Greases and Cutting Oils did better on every job! Concrete Pipe Machinery Co. says: "They are giving us outstanding service, and availability and delivery have always been excellent."

If you'd like to talk to a Cities Service Lubrication Engineer, write Cities Service Oil Company, Sixty Wall Tower, New York 5, New York, or call the office nearest you.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

Unless your operators work for nothing...

The savings in time alone will pay for New

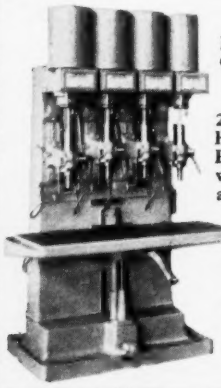
LELAND-GIFFORD DRILLING MACHINES

Convenient central controls, stepped-up speed, reduced work handling, built-in safeguards against costly errors, fast speed changes, quick adaptability to different jobs are some of the time-saving features of the new Leland-Gifford Drilling Machines which make it possible for the average operator to greatly increase machine production. And with the added advantage of higher precision, he can produce *better* work at the same time.

Leland-Gifford offers a complete line of motor spindle drilling machines — plus unsurpassed engineering skill and facilities for designing special tooling and adapting standard machines to meet any production drilling need. A Leland-Gifford field engineer can show you how to improve production and lower drilling costs with Leland-Gifford methods. Call the office near you.

No. 1LMS

Smallest holes up to 5/16"
Bench or floor types
One to Six Spindles
Speeds up to 10,800 RPM
12 or 20 inch Swing
Hand or Hydraulic Feed
Tapping by Friction
Tapping Attachment

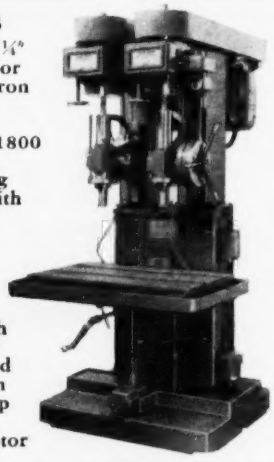


No. 2LMS

Holes from 1/16" to 3/4"
One to Six Spindles
Speeds up to 3600 RPM
20 or 26 inch Swing
Hand Feed; Power Feed with three feed rates and Positive, Adjustable Depth Stop; or Hydraulic Feed — either plain or step-by-step.
Tapping by Reversing Motor or Friction Tapping Attachment

No. 3MVB

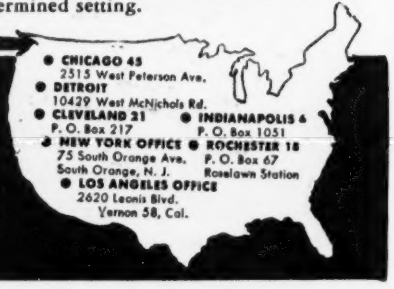
Holes up to 1 1/4" in Mild Steel or 1 1/2" in Cast Iron
One to Four Spindles
Speeds up to 1800 RPM
24 inch Swing
Power feed with three Rates, Adjustable Depth Stop and Safety Slip Clutch. Also can be furnished with Hand Feed or Hydraulic Feed — either plain or step-by-step Tapping by Reversing Motor



HYDRAULIC FEED

Two types of hydraulic feed are available — the well-known step-by-step type for deep hole drilling; and a plain feed for shorter holes or reaming. With either type the feed rate is *infinitely adjustable* and *independent*, and the maximum thrust pressure may be regulated with an overload release which withdraws the drill when the pressure exceeds a predetermined setting.

SAVE DAYS — CONTACT THE OFFICE NEAREST YOU



LELAND-GIFFORD

Drilling Machines

WORCESTER 1, MASSACHUSETTS, U. S. A.

For more information on products advertised, use Inquiry Card, page 247

UNION

ANNOUNCES

COUNTERBORES

WITH INTERCHANGEABLE PILOTS

Out of significant knowledge gained in making a wide variety of high precision cutting tools comes Union's High Speed Steel Counterbore with Interchangeable Pilots. Available in standard and aircraft designs. Call or write your Union Distributor for full information.

UNION TWIST DRILL COMPANY • ATHOL, MASSACHUSETTS

End Mills **Milling Cutters** **Gear Cutters** **Twist Drills** **Hobs** **Reamers** **Carbide Tools**

OWNERS AND OPERATORS OF: S. W. CARD MANUFACTURING CO. DIVISION, Mansfield, Mass.
BUTTERFIELD DIVISION, Derby Line, Vermont and Rock Island, Quebec

YOUR DISTRIBUTOR IS READY TO SERVE YOU PROMPTLY FROM FULL STOCKS

"We saved them time...increased tool life with one cutting oil!"

A large southern machine tool company and contract shop recently installed a 2½-inch, 5-spindle automatic screw machine on which different metals are machined every day.

Mr. Horace Lane, a Sinclair Industrial Lubrication Engineer, was called in to recommend a cutting oil that would perform equally well on brass, aluminum and steel. Mr. Lane reports, "It would have been impractical to drain 150 gallons of oil for each different contract job, so this machine needed a multi-purpose cutting oil – one containing both sulfur and lard for their wetting and anti-weld properties.

"From my past experience," Mr. Lane continues, "I recommended Sinclair SUPER WILKUT® which contains a balanced proportion of sulfur and fatty oil, in non-corrosive form, plus good heat-transfer characteristics. *Results were highly satisfactory!* Sinclair SUPER WILKUT saved time and money by eliminating frequent oil drains. It also helped to maintain close tolerances and prolonged tool life."

Why not let a Sinclair Lubrication Engineer help solve *your* lubrication problem. *There's no obligation.* Contact your local Sinclair office or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR CUTTING OILS

For more information on products advertised, use Inquiry Card, page 247

For Precise Cutting Based on Exact Jobs

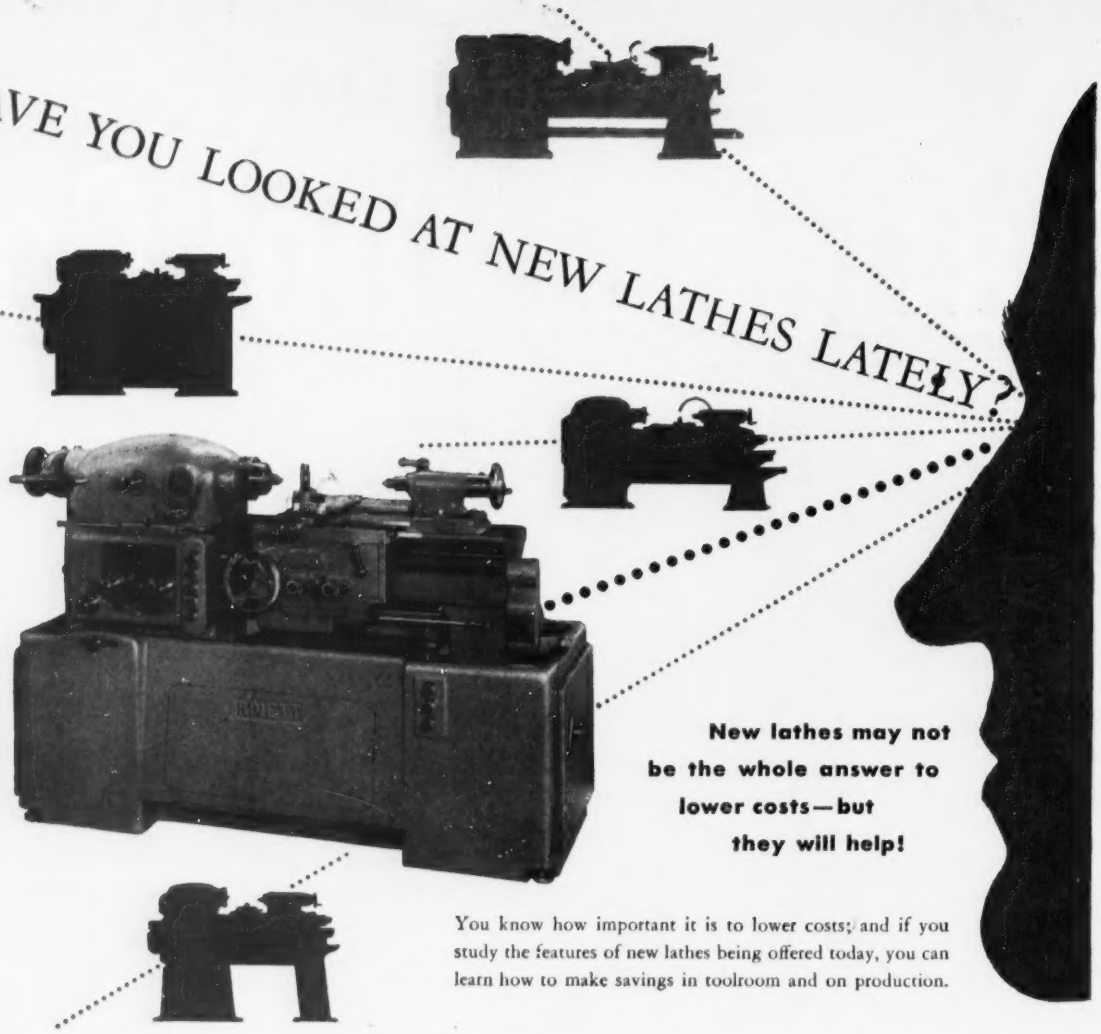
National Tool Co.

Years of successful experience in special tooling and related production problems are yours for the asking. When the job requires special cutting tools call in your National Tool Co. representative. He is backed by more than 49 years experience in the engineering and manufacture of special cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.

National Tools Cleveland

National
TOOL CO.
Cleveland 2, Ohio

HAVE YOU LOOKED AT NEW LATHES LATELY?



New lathes may not be the whole answer to lower costs—but they will help!

You know how important it is to lower costs; and if you study the features of new lathes being offered today, you can learn how to make savings in toolroom and on production.

Rivett offers two lathes for one!

This observation is particularly true if you look at the new Rivett Model 1020S Precision Toolroom Lathe. It features sensitivity for turning tolerances within .0004"; and heavy biting ruggedness for a ¼" cut at .020" feed in cold rolled steel. In short, it is an instrument lathe and an engine lathe combined to handle any work within its 12½" swing and 20" centers.

26 Features Distinguish Rivett 1020S

The Rivett Model 1020S is head and shoulders above any ordinary lathe. Its design includes 26 individual qualities that substantiate Rivett's reputation for extreme precision and economical production.

Write for free catalog

Why not write for the new Rivett Catalog 1020B and read these important 26 features—compare them with the designs of other makes of lathes—and thereby realize what a Rivett can do for your shop in the way of time and money (not to mention how happy it will make any *real* machinist to work with such *real* precision!)

RIVETT

RIVETT LATHE & GRINDER, INC., DEPT. MR-5 BRIGHTON 35, BOSTON, MASS.

For more information on products advertised, use Inquiry Card, page 247

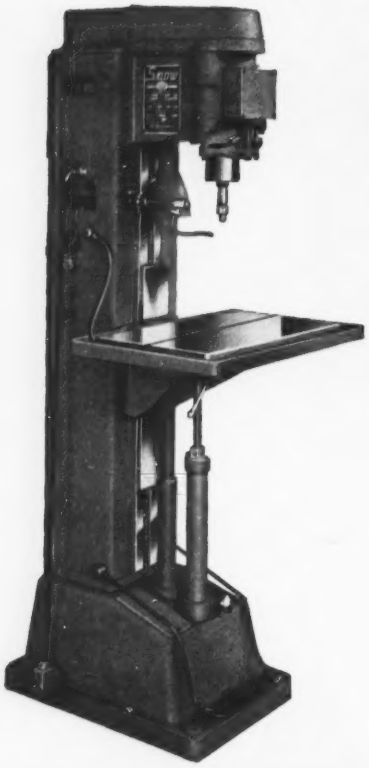
King - size

Here is one of the year's largest planers, a GRAY, immense in size, yet so superbly engineered and magnificently built that its precision performance is a marvel to behold. All GRAY planers from king-size Giants to eager Cubs are built for high production. They have more original engineering developments and production features than any other planer. They are in such demand that GRAY is the largest planer builder, further proof that *Quality doesn't cost . . . it pays.*

The G. A. GRAY Co., Cincinnati, Ohio

SNOW MANUFACTURING COMPANY

455 EASTERN AVENUE • BELLWOOD, ILLINOIS



FULL UNIVERSAL MACHINES

Electrically Operated—Air Controlled

. . . Drilling—TYPE "UD"

Capacities from #60 through 3/8" in two sizes

. . . Tapping—TYPE "UT"

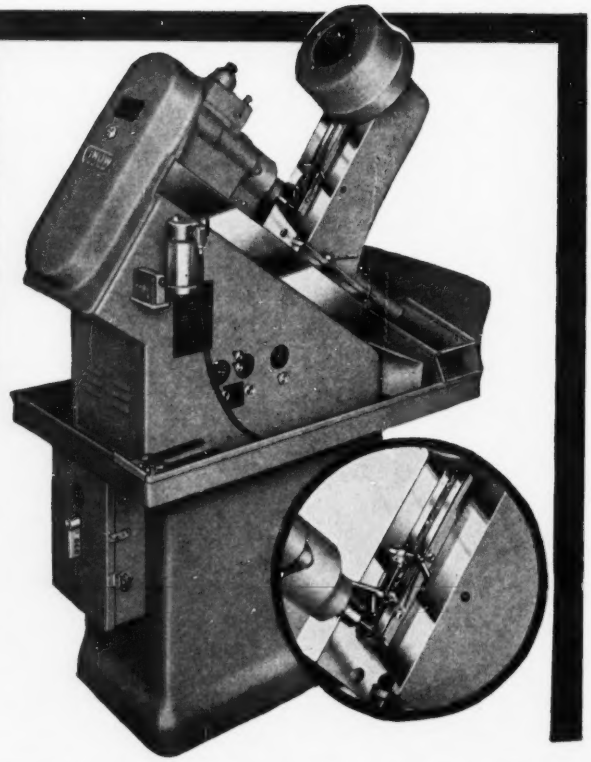
Capacities from #0 through 3/4" in four sizes

. . . Threading—TYPE "TR"

Capacities up to 1" in two sizes

AUTOMATIC and SEMI-AUTOMATIC JIGS and FIXTURES for Indexing and Clamping

A complete line of basic Master Fixtures to permit adaptation of a wide range of parts at high production rate with low tooling cost.



FULL AUTOMATIC *Nut Tapping Machines*

Completely automatic hopper feed nut tapping machines up to 5/8"—incorporating simplicity and low tooling cost. Standard taps are used. Precision class 3 and 4 fits and parallelism maintained at high speed and high production.

For more information on products advertised, use Inquiry Card, page 247

Put the Bite on Simonds!

...to cut your costs with the right type saw!

✱ INSERTED TOOTH SAW

For heavy production cutting of steel, brass, copper and aluminum. Alternating square and beveled teeth "tri-vide" chips for easy cutting and clearance. Maximum saw clearance gives cooler, freer cutting . . . permits extremely high rate of feed. High Speed Steel Teeth can be easily replaced singly or in complete sets, in your own plant.

✱ SEGMENTAL SAW

For especially smooth cuts on production work. Extra-service High Speed Steel toothed segments are securely held in a tough alloy plate by a tongue and groove design, have quick clearance for faster, freer cutting. Teeth are alternately square and beveled for easy cutting and clearance of "tri-vided" chips. Can be sharpened on any automatic grinder.

✱ SOLID TOOTH SAW

For general shop cut-off jobs . . . for use on smaller automatic cut-off machines, and for cutting jobs where narrow kerf is important. Clearance ground and furnished in High Speed, Si-Maloy (Pat.), or Semi-High Speed Steel. Simonds own steel, plus accurate heat treating and grinding give these saws longer life, more dependable performance.

CALL YOUR SIMONDS DISTRIBUTOR TODAY

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon Canadian Factory in Montreal, Que. Simonds Divisions: Simonds Steel Mill, Lockport, N. Y. Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

CIRCULAR Metal Cutting SAWS

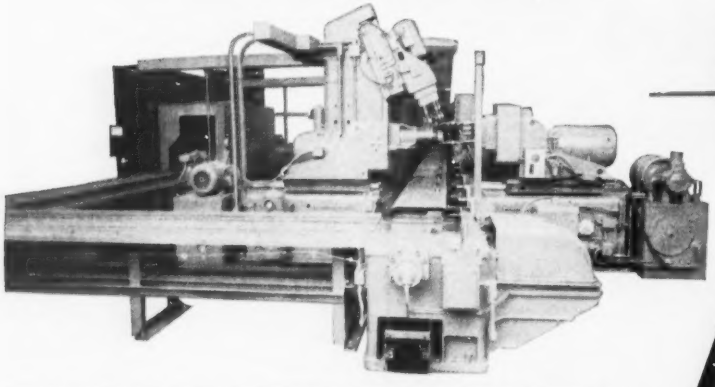
New Driver prevents tap

Scully-Jones Safe-Torque Driver rapidly being adopted to cut tapping costs!

Savings like these are why Scully-Jones Safe-Torque Drivers are being adopted so rapidly by machine tool builders and users. On the job illustrated, breakage has been virtually eliminated. On a radial drill, *only two taps* were broken tapping 500,000 holes—former average was a broken tap for every 200 holes tapped.

This remarkable record is the result of two advance-design features. (1) A spring-loaded centering plug absorbs shocks when bottoming in blind holes. The cushioned stop and instantaneous release of the drive permit bottom-tapping at full speed to full depth without breakage. (2) The overrunning roller drive releases completely when the tapping torque reaches a preset danger point. There's no intermittent overriding motion (*impact action* and *vibration*) . . . no slipping friction surfaces (*overheating*) to cause wear, poor control over torque settings, and inaccurate work. You get uniform, accurate threads. And adverse tapping conditions, such as hard spots, poor chip removal, inadequate cooling or lubrication, and improper sharpening of taps, are brought under new, more effective control.

Call your Scully-Jones representative or distributor—factory trained "Precision Tool and Work Holding Specialist"—for information about Safe-Torque Drivers, *today!*

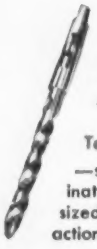


Transfer machine, built by Buhr Machine Tool Co., Ann Arbor, Michigan, is factory-equipped with special Scully-Jones Safe-Torque Drivers for safe tapping in automobile clutch housings.

Patent Pending

Scully-Jones Nonreversing Safe-Torque Drivers may be used in any machine having a reversing spindle.

THERE'S A SCULLY-JONES PRECISION TOOL FOR EVERY HOLDING OR DRIVING NEED



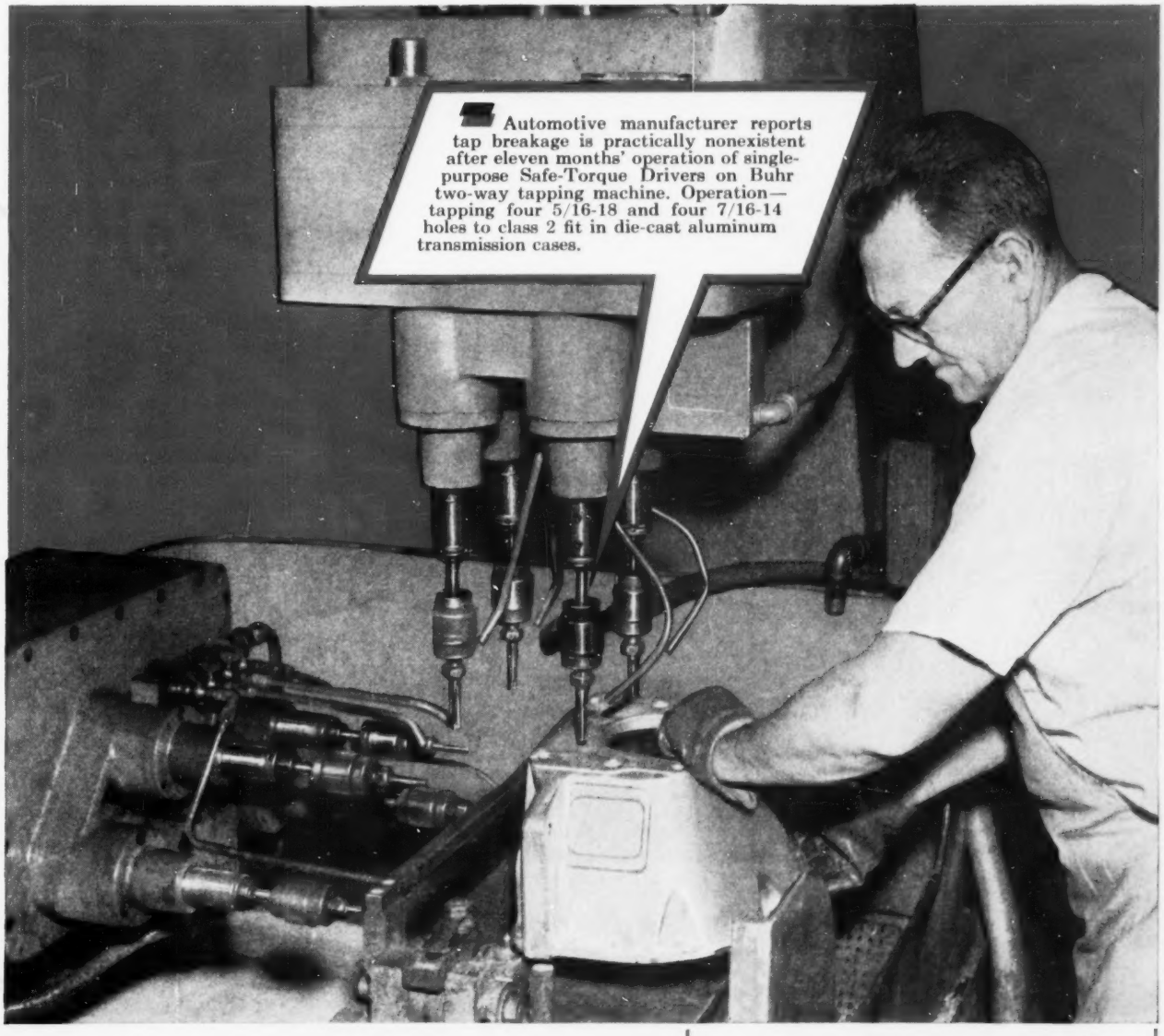
Drill Chucks
—for driving straight shank tools. Permit use of jobber-length drills, saving extra cost of taper shank drills.

Tap Chucks
—save costly setup time. Eliminate bell-mouthed and oversized tapped holes. True collet action on shank of tap.

Close-Center Tap Drivers
—for tapping holes close together or near shoulder of work. Collet action minimizes strain and saves taps.

Quick-Lock Adapters
—permit accurate depth adjustments in cluster of spindles. Stop guesswork on fine adjustments. Speed tool changes.

breakage on Buhr Specials


Automotive manufacturer reports tap breakage is practically nonexistent after eleven months' operation of single-purpose Safe-Torque Drivers on Buhr two-way tapping machine. Operation—tapping four 5/16-18 and four 7/16-14 holes to class 2 fit in die-cast aluminum transmission cases.

SCULLY JONES

Precision Holding

FOR HOLDING PRECISION

Scully-Jones and Company, 1906 South Rockwell St., Chicago 8, Illinois

WRITE FOR NEW BULLETIN 20-50

Gives you important features, specifications, and field test reports on Safe-Torque Drivers.

Gentlemen: I'm interested in learning more about Scully-Jones Safe-Torque Tap Drivers . . .

☐ Please send Bulletin 20-50.

☐ Have representative call.

Name_____

Company_____

Address_____

City_____ State_____

For more information on products advertised, use Inquiry Card, page 247

Beaver STANDARD ARBORS AND ADAPTORS CUT DOWN-TIME LOSS—ASSURE ACCURACY FOR YOUR CUTTING TOOLS!

The finest economy in the purchase of arbors and adaptors is quality.

Beaver Standard Tools are made to unusually high standards of quality. No stinting is permitted on workmanship or materials. Beaver Standard Tools are made with the same care and accuracy as precision aircraft parts . . . hard, and wear resistant, on the surface but with a strong, tough core.

Remember, an extra set of arbors and adaptors is cheap insurance against loss from down-time in case of emergency.

You'll do a better job with less investment with Beaver Standard Tooling—try it, you'll like it too.

Beaver TOOL AND ENGINEERING CORPORATION

2850 ROCHESTER ROAD • BOX 429, ROYAL OAK, MICHIGAN

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"where can I get a good, small general purpose hydraulic press... *quickly?*"

"HANNIFIN HAS THEM FROM 1 TO 10 TONS FOR PROMPT DELIVERY!"

Yes, Hannifin is your best source for small, general purpose hydraulic presses. And, you can get *almost* immediate delivery because the demand for these popular presses is so consistent that Hannifin is able to make them in quantity.

This *continuous* quantity production works to your advantage price-wise, too, because the savings of volume production are passed along.

The quality of these small presses is identical to that of the larger Hannifin presses that are built to order. Fast acting, single-lever and dual-lever manual controls are standard, but optional controls, including Hannifin's patented Sensitive Pressure Controls, are available on the 5-, 8- and 10-ton models. Maximum pressure can be adjusted from 10% of capacity to full capacity on all models.

select the press you need from this chart...

CAPACITY, tons	1-ton	2-ton	5-ton	8-ton	10-ton
MODEL NUMBER	F-10	F-20	F-50	F-80	F-101
RAM SPEED (in.–min.) Down	400	190	120*	73*	130
RAM SPEED (in.–min.) Up	800	345	240*	151*	254
PUMP (gpm.)	3.3	3.3	5*	5*	11
MOTOR (hp)	1½	1½	2*	2*	5
STROKE (in.)	6	6	10	10	12
GAP (in.)	10	10	16	16	22
REACH (in.)	6	6	7½	7½	10
BULLETIN	H-784	H-784	135	135	134

PRICES WILL BE SENT PROMPTLY ON REQUEST

Check ✓ *THE BULLETINS YOU WANT ON THE COUPON*

**Supplied with larger motor and pump when higher ram speed is required.*

mail the coupon!

Hannifin Representatives Are at Your Service In These Leading Industrial Centers

Atlanta, Buffalo, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, Houston, Los Angeles, Milwaukee, Minneapolis, Moline, New Orleans, New York, Philadelphia, Pittsburgh, St. Louis, Seattle; Richmond, Va.; Rochester, N. Y.; South Bend, Ind.; Washington, D. C.; Worcester, Mass. In Canada: TEM Sales Company Ltd., Toronto and Windsor

HANNIFIN

Hydraulic and Pneumatic Presses from ½ Ton to 150 Tons
Air and Hydraulic Cylinders • Riveters • Air Control Valves

Hannifin Corporation
1109 S. Kilbourn Ave., Chicago 24, Ill.
Please send bulletins checked, together with prices:

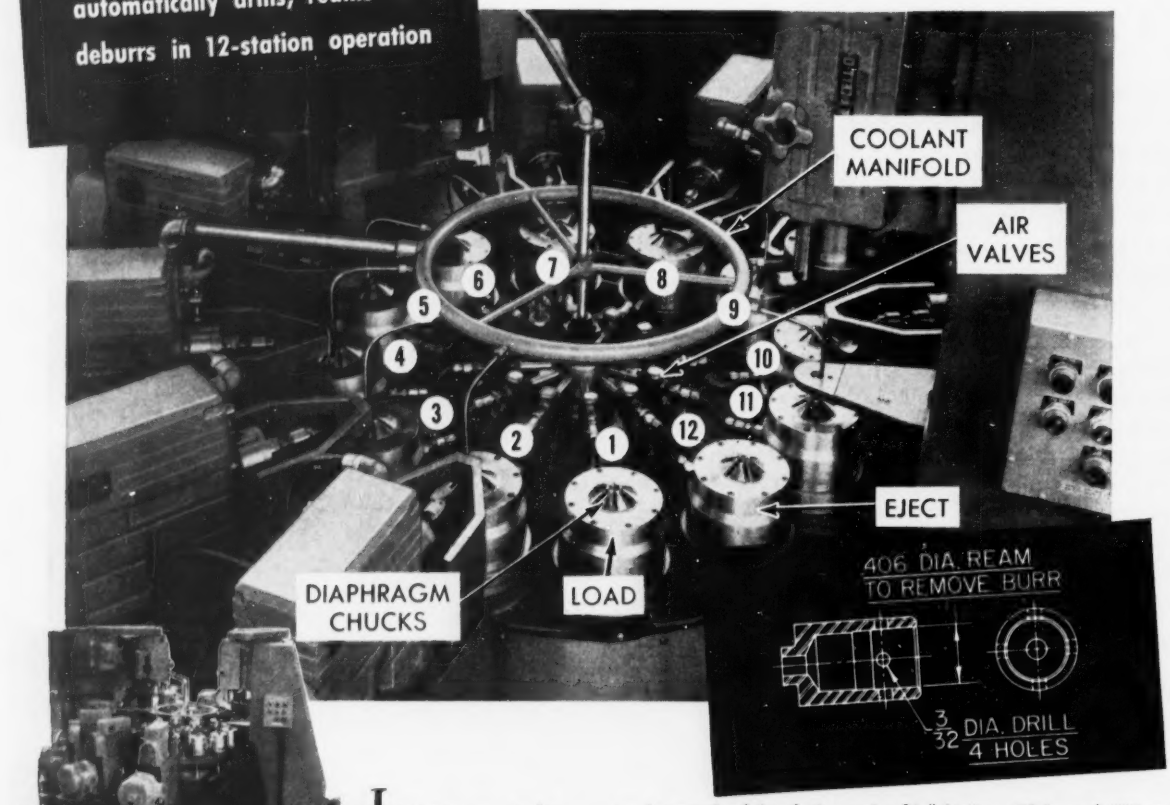
☐ Bulletin H-784 ☐ Bulletin 135 ☐ Bulletin 134

Name.....
Position.....
Company.....
Address.....
City.....*State*.....

For more information on products advertised, use Inquiry Card, page 247

1400 WORK PIECES PER HOUR at 100% EFFICIENCY!

Special-purpose Turner Machine automatically drills, reams and deburrs in 12-station operation



LOADED at *station 1*, the work piece is automatically clamped in a diaphragm chuck by means of air valves mounted in the center of the indexing table, then indexed to *station 2* where one 3/32" dia. hole is drilled while operator loads another part. Indexing to *station 3*, the diaphragm chuck rotates 90° and another 3/32" hole is drilled. The same operation takes place at *stations 4 and 5* while the indexing and loading cycle continues.

At *station 6*, a .406" dia. hole is reamed by a vertically mounted reamer, removing the burr caused by drilling. At *stations 7, 8, 9* and *10*, the drilling operation is repeated since the reaming causes some of the burrs to be pushed back into the 3/32" holes. This redrilling pushes the burr back into the .406" hole and is finally removed entirely at *station 11* by a duplicate vertical reaming operation. At *station 12*, the part is automatically ejected by means of a cam attached to the indexing table.

All components of this machine are standard: base, columns, "Hautau-Turndex" indexing table, drill units and diaphragm chucks. Should you stop production of one kind of part and contract to produce another, the Turner machine, with its standard components, can be used again on your new job.

If you have a production or inspection problem for which you can use to advantage a special purpose machine, write today describing your problem. After our engineering department analyses it, our field engineer will discuss it with you.

TURNER BROS. INC.
2625 HILTON ROAD
FERNDALE 20, MICHIGAN
DESIGNERS and BUILDERS of:
- SPECIAL MACHINES
- JIGS and FIXTURES

For more information on products advertised, use Inquiry Card, page 247

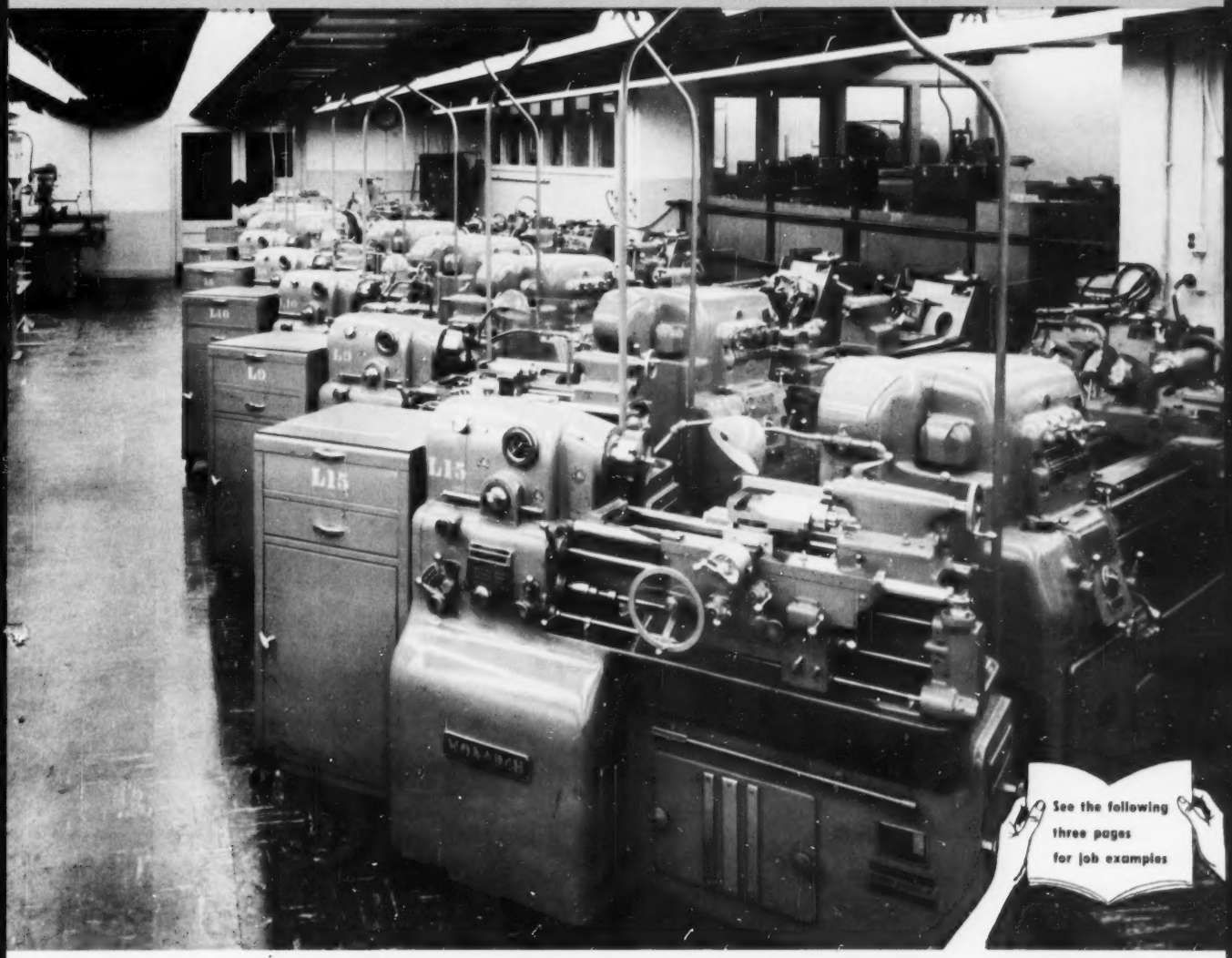
If you're paying for them...

why not have them?

BY THEM, we mean modern, productive lathes. If you are using them now, you *know* they more than pay their way. Should you be struggling along with obsolete machines, your higher costs often equal new equipment costs in a surprisingly short period of time.

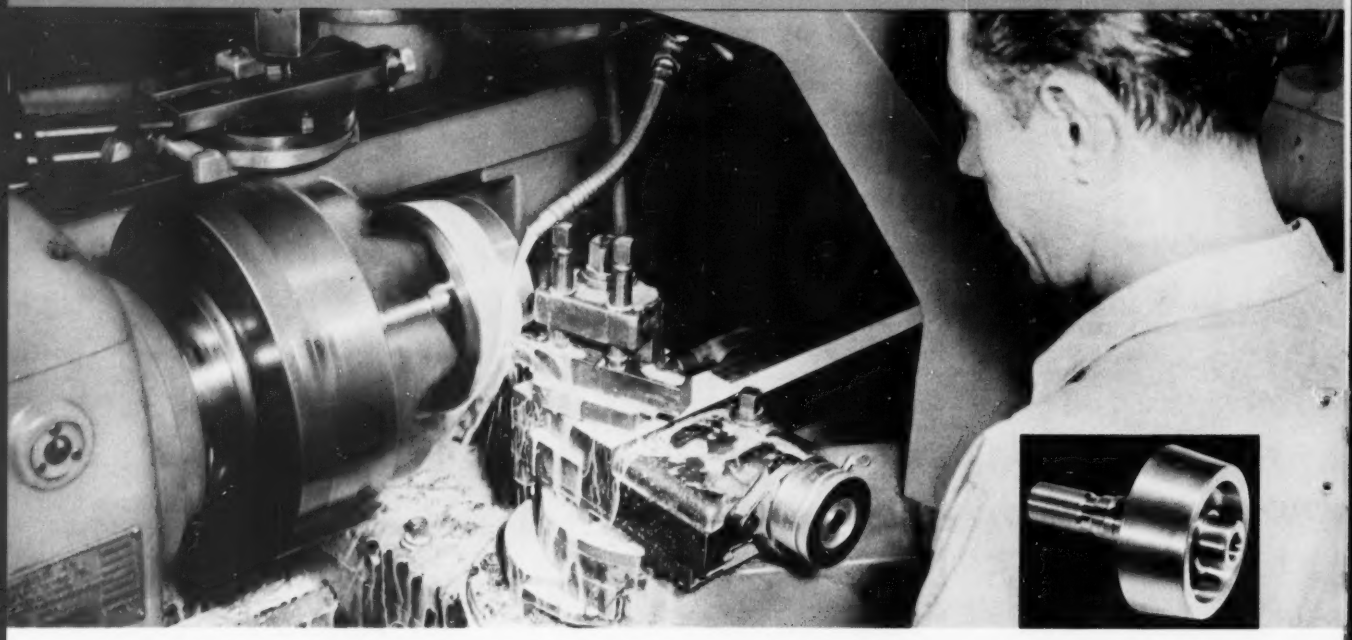
Your turning needs may be served by only a few lathes. Or, they may be counted in the hundreds. Regardless of the number, there are probably Monarch models with the productive capacity to reduce your turning costs—with the inbuilt accuracy materially to improve quality of output.

See the job examples on the next three pages. Check the record of time saved; quality improved. Then ask your Monarch representative to show you how turning results like these can be secured in *your* shop.



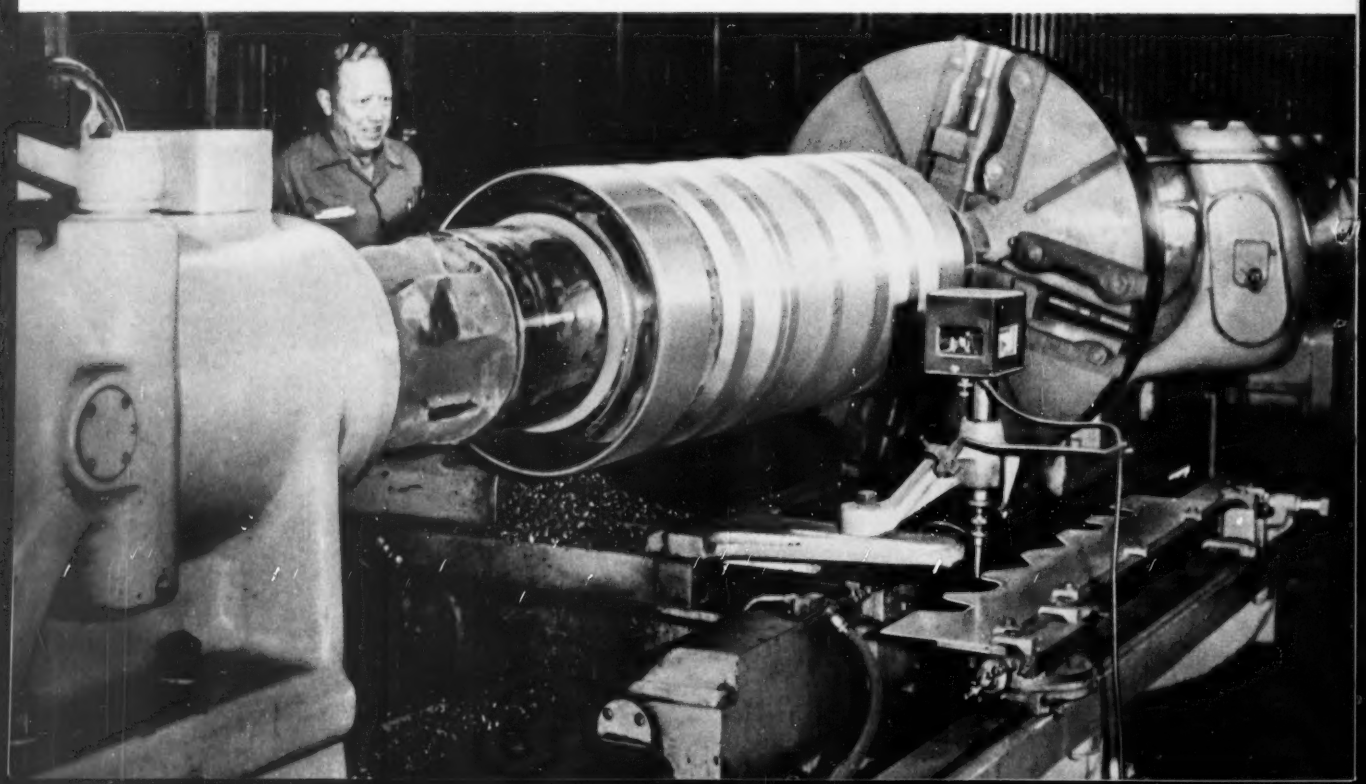
Much tidier and more condensed that most—but this impressive Monarch installation is located in one of the world's most respected laboratories, not a typical shop. The turning section is exclusively Monarch—23 machines strong. There are thirteen 10″ x 20″ Model EE Sensitive Precision Toolmaker's Lathes—one Speedi-Matic—seven 13″ x 54″ Series 60 Toolmaker's Lathes and two 16″ x 102″ Series 60 Engine Lathes. This customer, selecting machines for combination of accuracy and versatility so essential to experimental work, *bought Monarch exclusively!*

These Are Typical Monarch Production

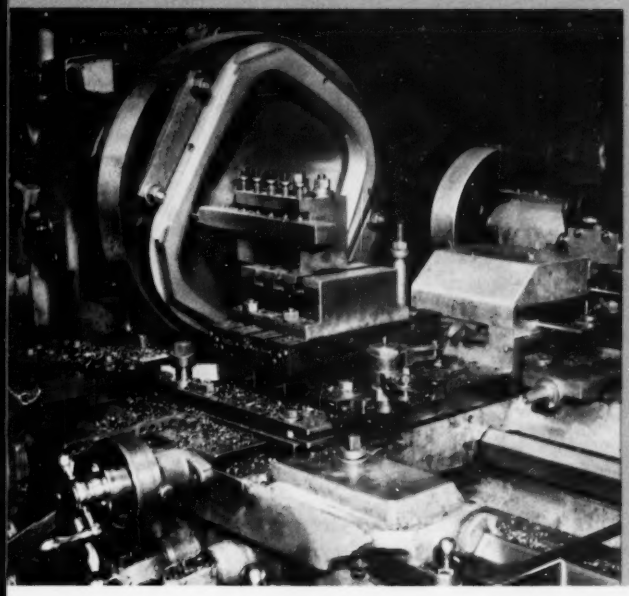


Now it can be done! Here a Monarch 20″ Series 60 Lathe with swiveling type Air-Gage Tracer completely turns and bores gear blanks for helicopter transmissions. Parts are heat treated AISI 9310 forgings. Limits on many diameters are ± .001″. The complexity of operations can be seen in small photo, and are such that efforts made to turn part on other tracer controlled machines without the exclusive Monarch swiveling feature were unsuccessful. The Monarch Air-Gage Tracer is the most accurate duplicating device made, holding limits of ± .001″ on most work, and is applicable to all sizes from 10″ to 32″ swing. Monarch Air-Gage Tracer controlled lathes may be used with equal proficiency for turning step shafts and the turning, boring and facing of a vast variety of contours.

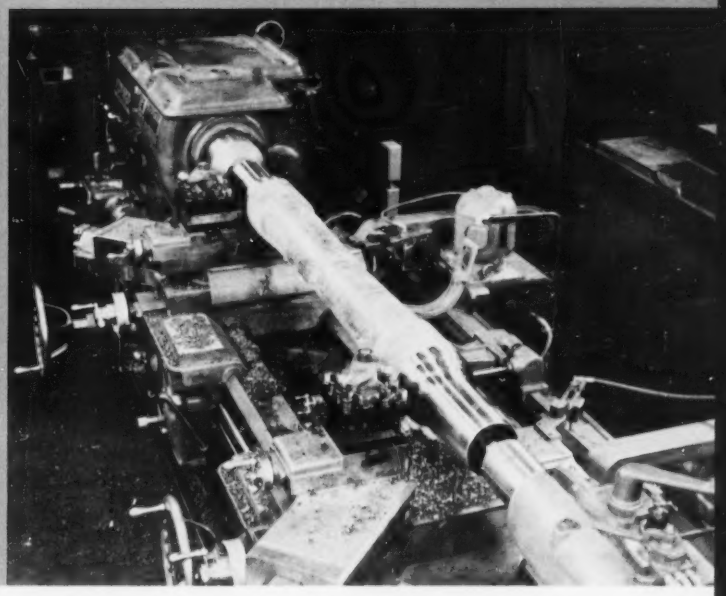
Turning Time Slashed—31 hours to 12¼ hours. Users of the Monarch Heavy Duty Roll Turner with Monarch-Keller controls report consistently marked savings of which the following is a typical example. Operation: roughing body down from straight, rough turning and finishing all passes over a 10″ diameter by 30″ body length. The grain iron roll has 13 half round passes ranging from 1⅝″ to 1 13/16″ diameter. Comment: production has been increased almost 3 times over previous conventional methods and operator effort greatly reduced.



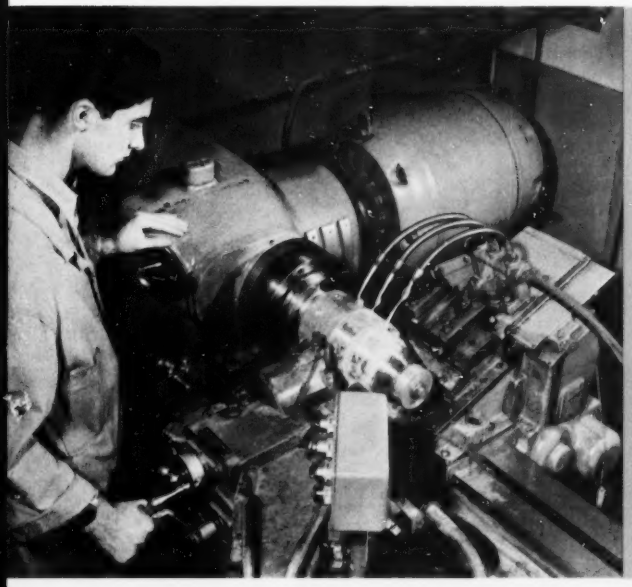
Stories...Can Your Equipment Equal Them?



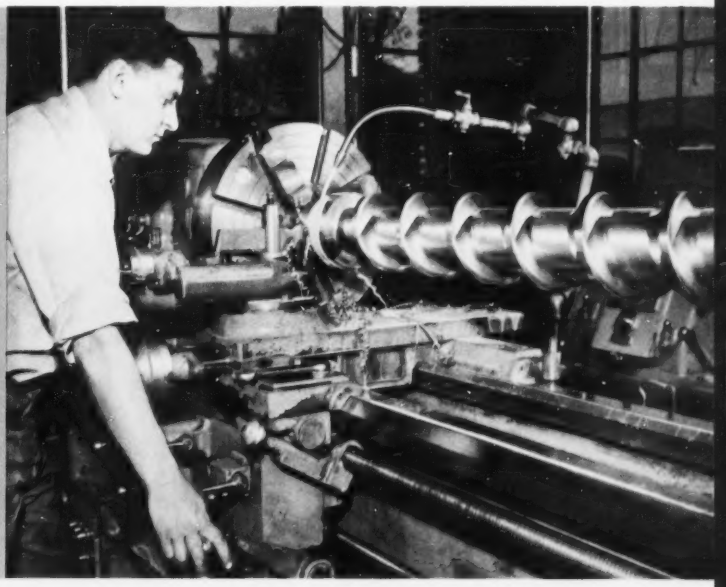
"No other machine can do the job as well," says user. The unique Monarch Shapemaster Engraver produces unusual forms and shapes — and with a degree of accuracy — impossible by other machining methods. Here, it turns a television tube mold. Production savings of 12 - 15 up to 100 times previous handwork methods can be realized in making molds for glassware industry generally — also for plastics and mechanical rubber industries.



Critical finish turning time cut 50%! This Air-Gage Tracer application to Monarch 25" Model N Heavy Duty Lathe shows Monarch equipment specially modified for better output. One of two machines used by large freight car manufacturer, it has dual carriages, each with Air-Gage Tracer Slide for turning anti-friction freight car axles. Right and left hand carriages contour turn toward headstock and tailstock respectively. *Finish turning time is cut in half!*



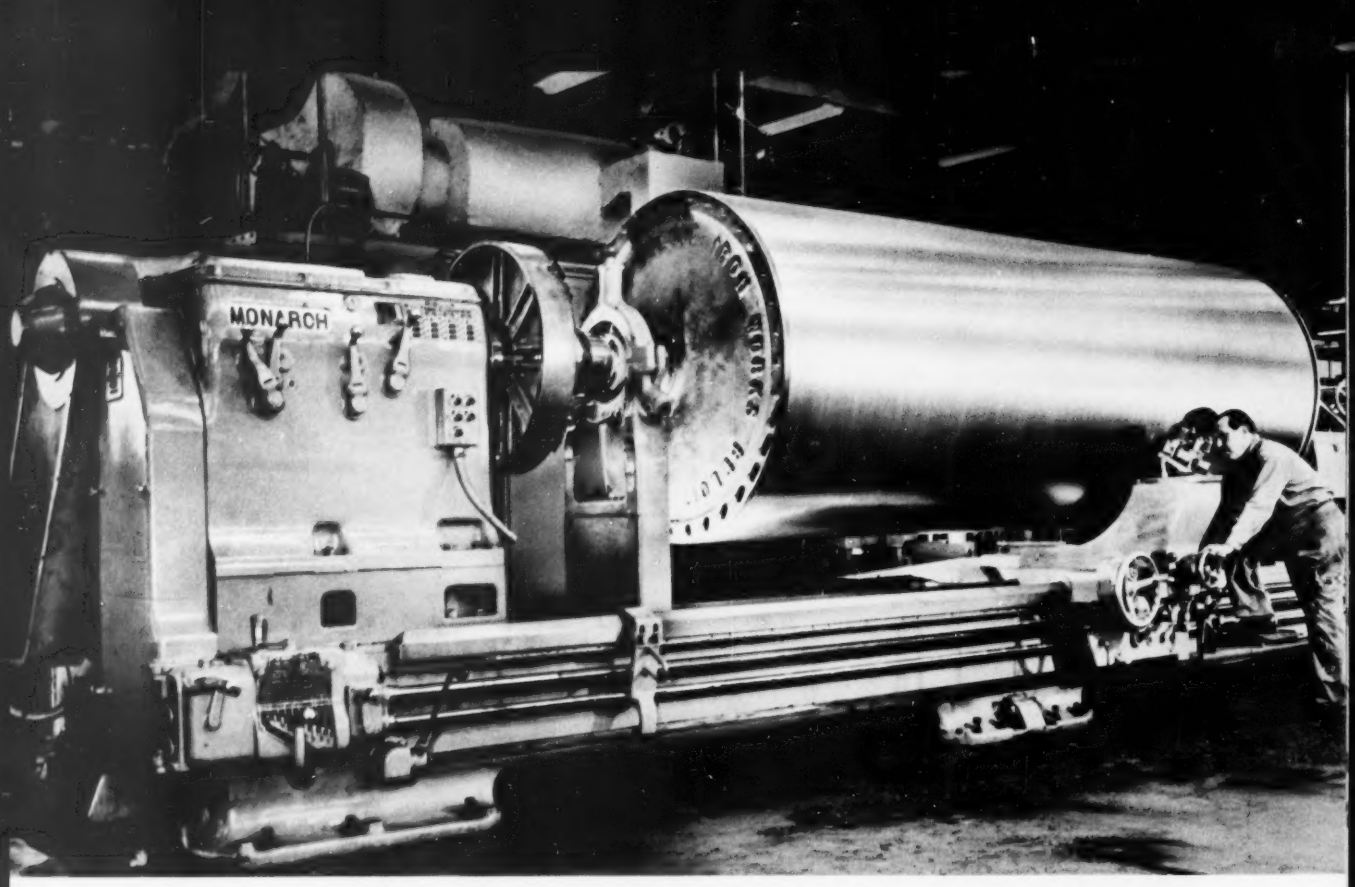
Time saved — 6-7 hours per piece! Admittedly, this hush-hush part is pretty special — an unusual electro formed piece of pure nickel previously ground direct from the electro forming. A tough machining job! But our Mona-Matic scores again — with only a brief grind required to finish the job. Two pounds of metal are removed in one pass of the front running tool — with two tools on rear slide performing prior forming cuts. Limit is .002" TIR overall. Wall thickness is only .017"



Better turn for better plastic coating. Part is extruder screw for electrically heated extruder made by Hartig Engine and Machine Co., Hillside, New Jersey. Screw is turned over its entire length including O.D. of worm — and journal at end (not shown) is threaded. Limits are ±.0005". Intermittent nature of cut and fact that stainless steel screws are often used testify to in-built ruggedness and accuracy of the Monarch Series 60 Engine Lathe used. Comment: there are now 3 more Monarchs in this user's plant!

THE MONARCH MACHINE TOOL COMPANY

SEE NEXT PAGE



King-Size! It's a Monarch Heavy Duty Lathe with plus-swing of 84". Ideal for maintenance and repair — for occasional big parts, light cuts on big diameters, turning shafts with previously machined large sections. Here it turns a paper drum — has been adapted for rewinding paper machine wire drums. You can get Monarch Heavy Duty Lathes in three standard swings—20", 25" and 32".

Are you Getting Results like these?

If you aren't getting results like you've seen on these four pages, send the coupon now and get the details you've been missing. Our machine booklets are fully descriptive—with data, photos, job reports and a list of specifications that will show you why the Monarch name is so respected. Once you learn how Monarchs are built, you'll understand why they can build turning output for you . . . *The Monarch Machine Tool Company, Sidney, Ohio.*

Sensitive Precision Toolmaker's Lathe—10" Model EE • Precision Manufacturing Lathe—10" Model EE • The Speedi-Matic. A fast, hand screw machine • The 13" Model EE Precision Lathe • Engine and Toolmaker's Lathes—13", 16", 20" Series 61 • Heavy Duty Lathes—20", 25", 32" • The Mona-Matic. For high production metal turning • The Air-Gage Tracer • Monarch-Keller Form Turning Machines • Motor-Trace Lathes • Roll Turning Lathes • The Shapemaster Engraver

THE MONARCH MACHINE TOOL COMPANY, Sidney, Ohio

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☐ Please send me complete descriptive literature. I am interested in the following types of lathes _____

☐ Please have a Monarch Sales Engineer call on me.

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ADDRESS _____

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Monarch

ACCURACY • ECONOMY • LONG LIFE

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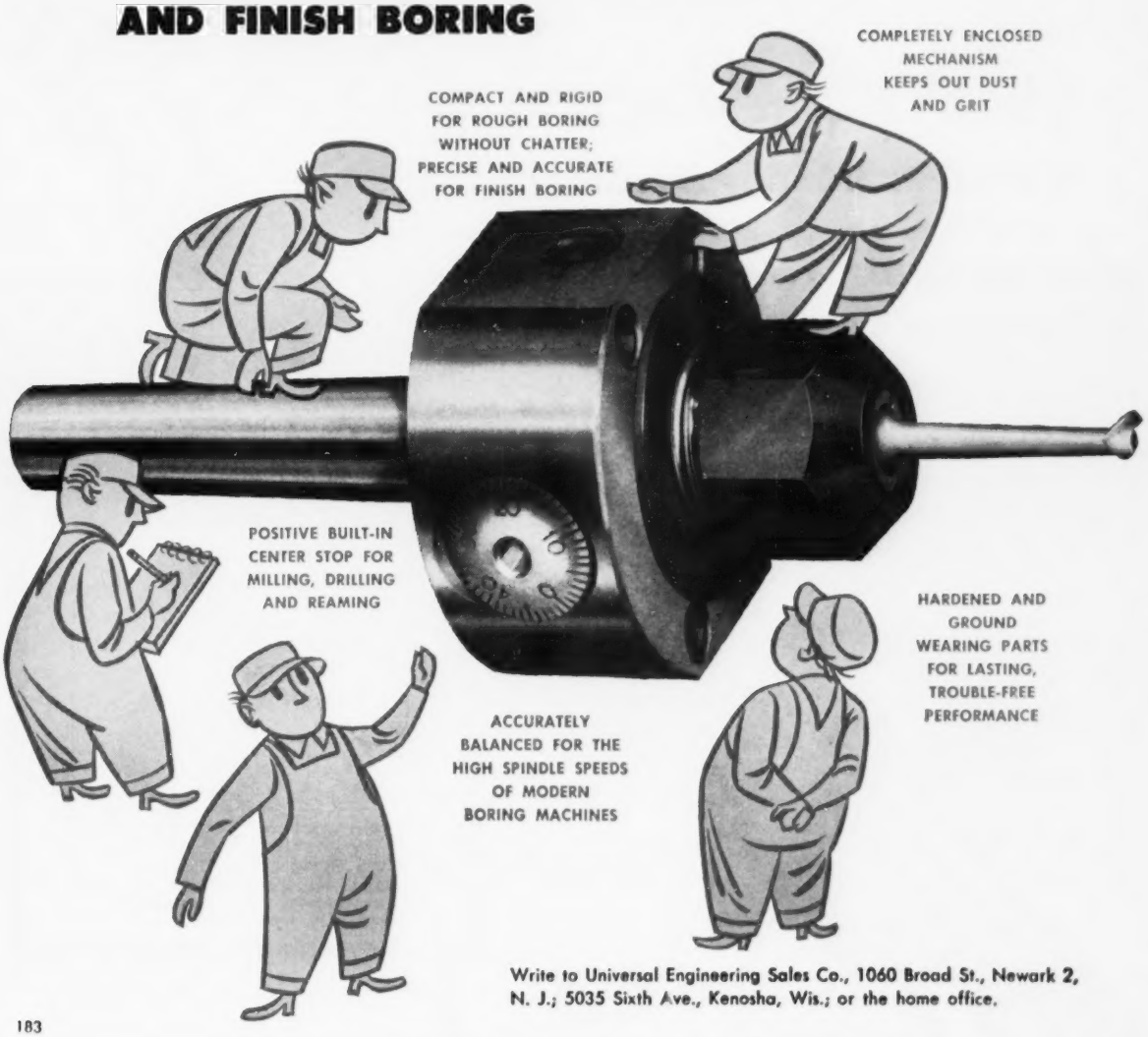
FOR A GOOD TURN FASTER . . . TURN TO MONARCH

UNIVERSAL BORING CHUCKS

FOR ALL TYPES OF ROUGH AND FINISH BORING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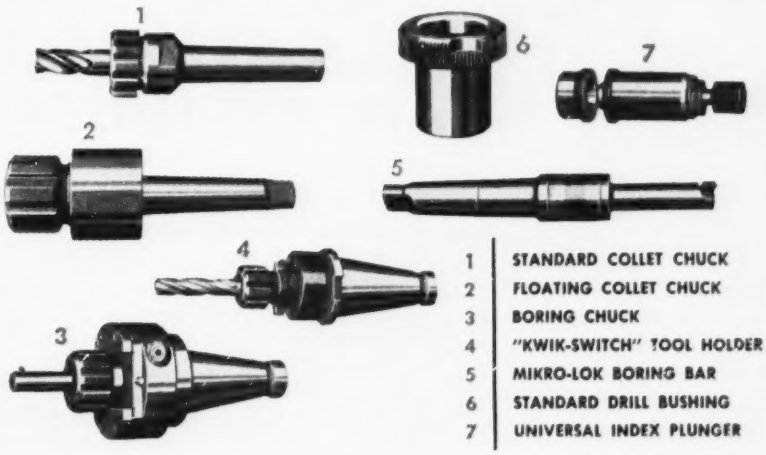
UNIVERSAL ENGINEERING COMPANY
FRANKENMUTH 2, MICHIGAN



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3	BORING CHUCK
4	"KWIK-SWITCH" TOOL HOLDER
5	MIKRO-LOK BORING BAR
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✓SAVE UP TO 40% SPACE!

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✓DEPENDABILITY . . . backed by 38 Years of Know-How!

T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

Off shelf delivery all styles to 3" bore in increments of 1" to 12" stroke.

NEW (T-J)

Spacemaker AIR CYLINDERS

Streamlined design of the new T-J Spacemaker *eliminates tie rods . . . saves up to 40% in mounting space!* It's performance-proved . . . *super rugged* with extra high safety factor . . . solid steel heads . . . heavy wall, precision honed, *hard chrome plated,* seamless steel body . . . leakproof cylinder head to body construction . . . heavy duty, hi-tensile, *hard chrome plated* piston rod.

Available with the new T-J Super Cushion Flexible Seals which insure positive cushion with automatic valve action for fast return stroke. Many standard sizes and styles . . . for pushing, pulling, lifting, clamping or control jobs. T-J dependability. Write for bulletin 454. The Tomkins-Johnson Co., Jackson, Mich.

(T-J) TOMKINS-JOHNSON

RIVETORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

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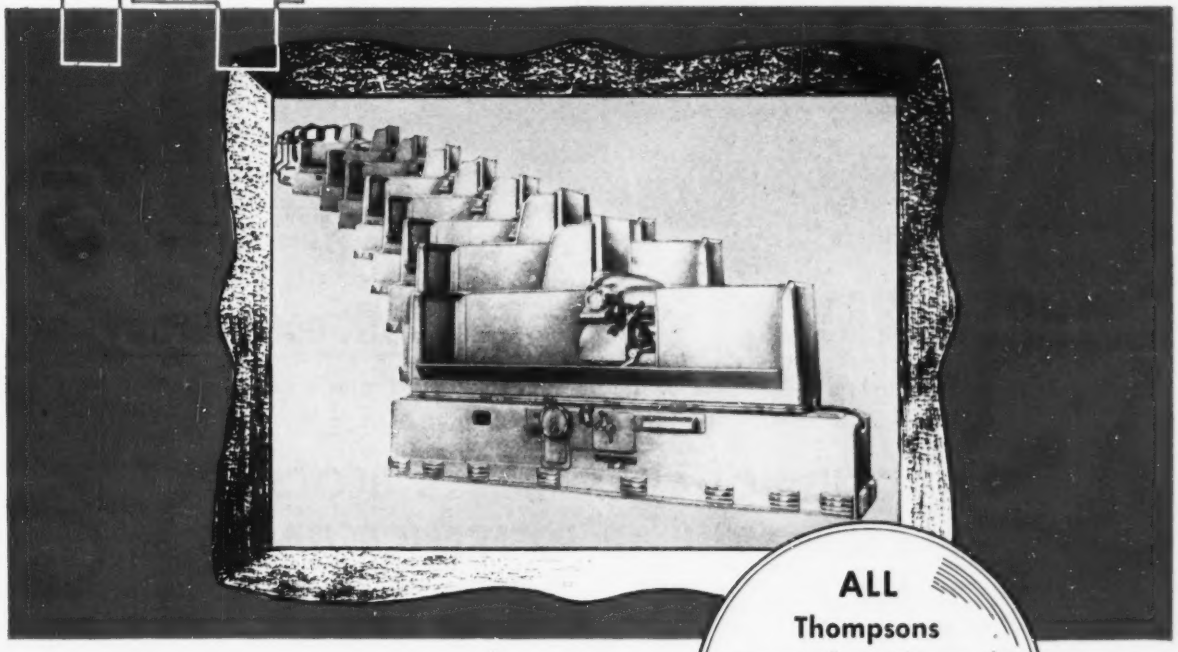
LOOK CLOSELY AT THIS PICTURE
OF GRINDER PRODUCTION AND SEE WHY...

14 is a lucky number

for a manufacturer requiring precision grinding



ALL Thompsons operated continuously with much LESS DOWNTIME

that's why

it will pay you to invest in

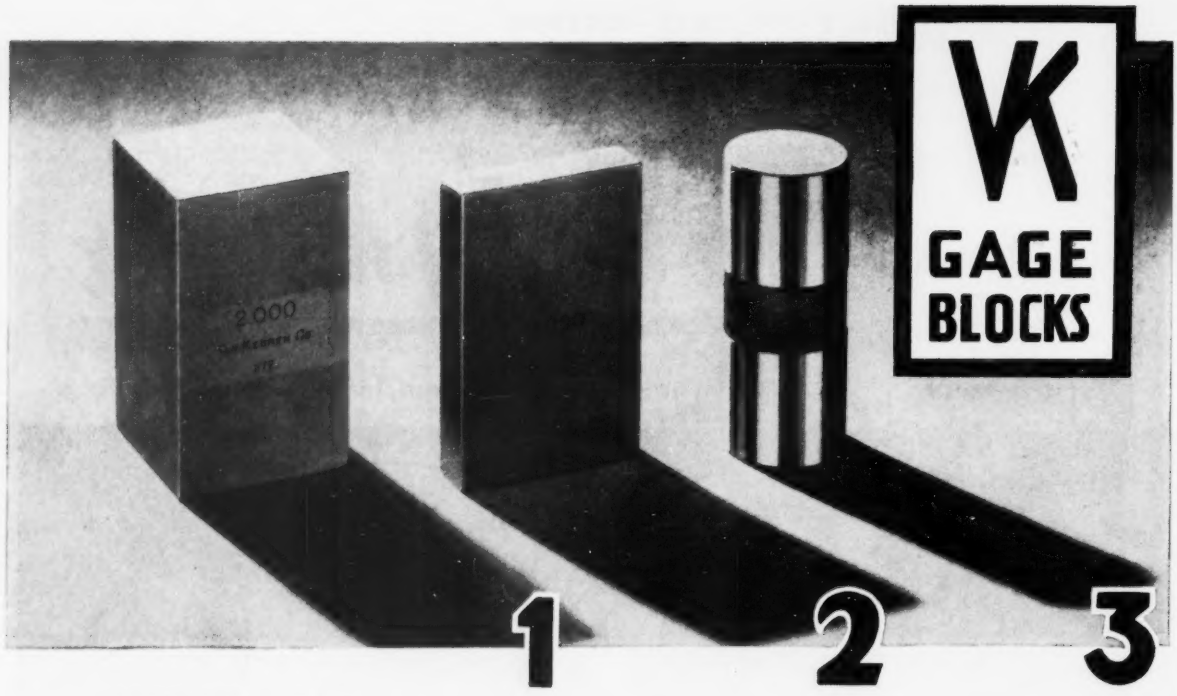
Thompson Grinders

After twelve years continuous manufacture of precision ground products, ten Thompson Surface Grinders proved so efficient and economical that this manufacturer ordered four more machines.

Thompson Grinders are available in a wide range of types and sizes from 6" x 18" to 72" x 384" to meet all production, special or tool room grinding requirements. The Thompson line includes machines from giant Hydrial Way Grinders to automatic Truform Jet Blade Contour Grinders, Dual Rotary Grinders and Broach Grinders.

CONTACT THOMPSON TODAY FOR HELP WITH YOUR MACHINING PROBLEMS

THE THOMPSON GRINDER COMPANY
Springfield, Ohio



THREE WAYS to protect production accuracy

To meet closest limits of accuracy and protect production, Van Keuren is currently furnishing three types of gage blocks:

1—SOLID SQUARE MASTER BLOCKS
2—RECTANGULAR REFERENCE GAGES
3—MICROGAGES

Shipment on complete sets of any of these three types can be made within 60 days from receipt of order.

VK Solid Square Master Blocks are accurate to .000004" per inch of length and are designed for laboratory use or to standardize all shop dimensions. Large wearing surface; perfect parallelism. Available in 85- and 41-block sets and guaranteed unconditionally for 5 years not to exceed .0001" in wear.

VK Rectangular Reference Gages are guaranteed accurate to .000008" per inch of length and are designed for the inspection department or precision set up work. They are available in 81-block and 33-block sets. Individual blocks from either of these sets can also be furnished. Certificate of size is also furnished with each set.

VK Microgages are accurate to plus .000012", minus .000008" per inch of length and are designed as working gages for shop use . . . to put accuracy at the machine. Wearing surface is 40% greater than that of rectangular gage blocks hence their long-wearing quality. Available in several set combinations.

Van Keuren Gage Blocks are fully described in Catalog and Handbook No. 35, yours for the asking by writing: The Van Keuren Co., 178 Waltham St., Watertown, Mass.

VK

35th YEAR

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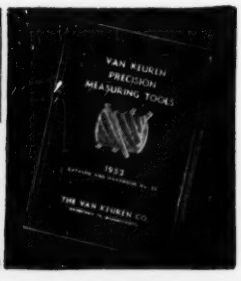
178 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires Chrome Carbide Taper Insert Plug Gages



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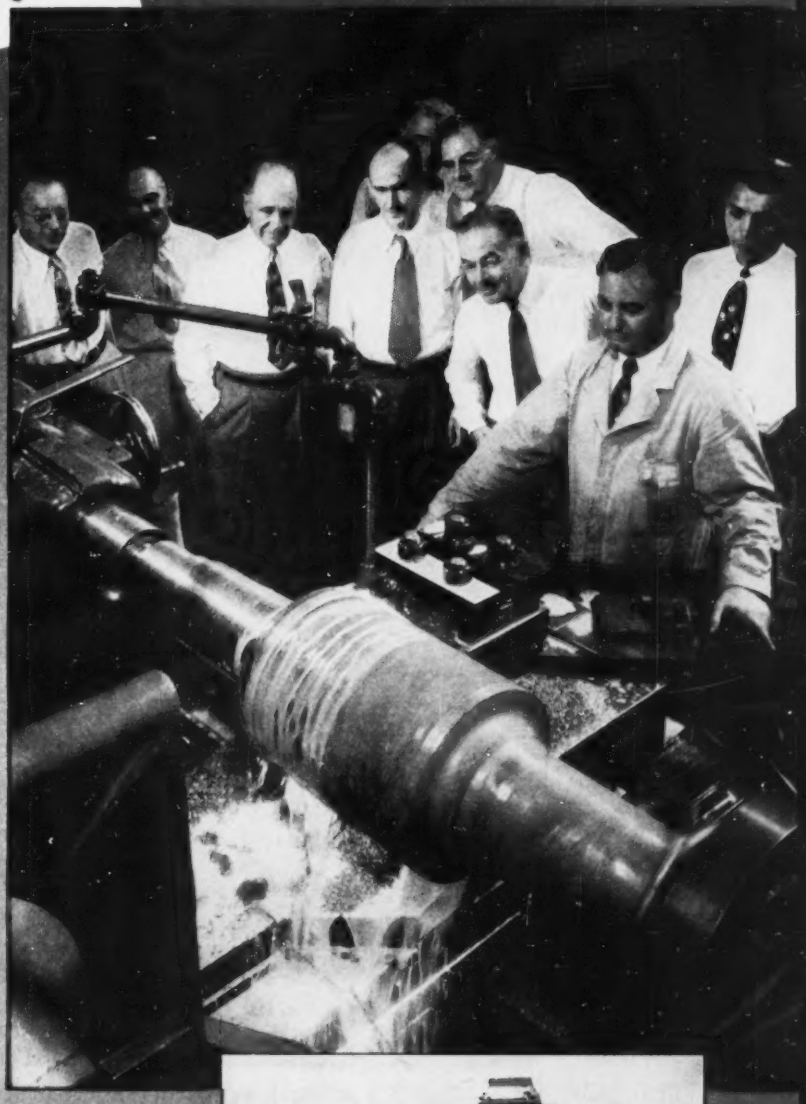
It MUST have been good!

There are times when expressions speak louder than words.

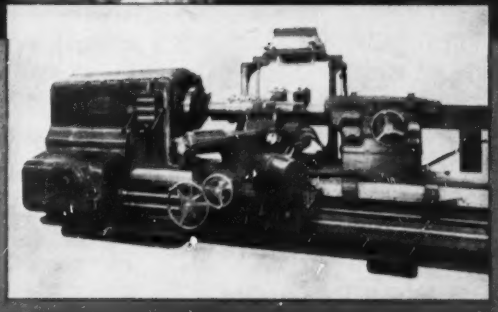


Here's a group of distinguished steel mill roll executives watching a demonstration on a 26" Capacity "AMERICAN" Hydraulic Roll Lathe—judge for yourself whether or not they are satisfied with what they saw.

These machines are performing "miracles" in savings in many of the best known roll shops in the country. They have introduced a brand new machining technique that has revolutionized the art of roll turning. They reproduce work shapes from a template faithfully and accurately not only on steel mill roll bodies and necks, but on such work as spindles, motor shafts, valve stems, step shafts, piston rods, axles and a wide variety of chucking work having irregular contours.

Evidence from hundreds of installations proves beyond a shadow of a doubt their leadership as top-flight cost reducers. Was there ever a time when cost reduction was more urgently needed?

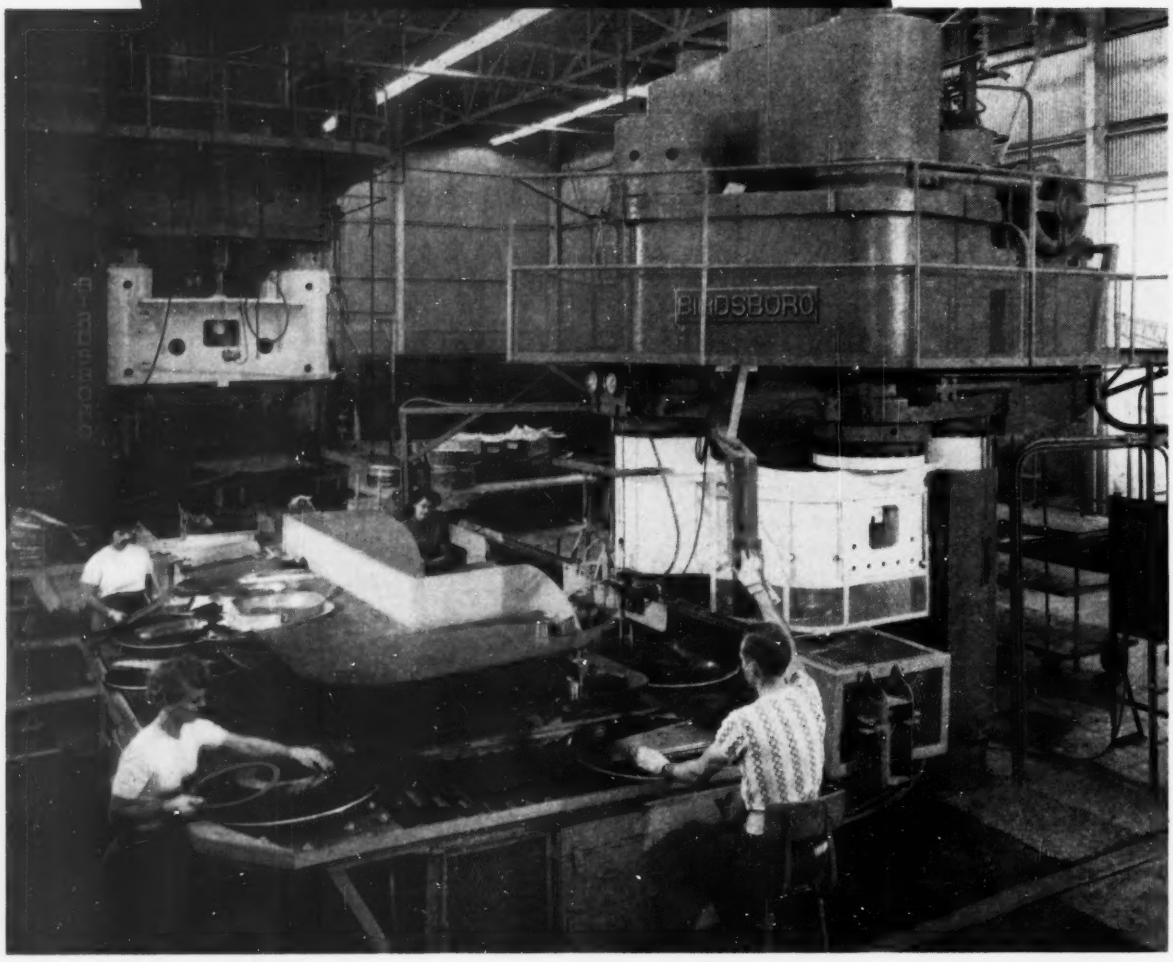
If it's proof you want just drop us a line—no obligation.



THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

FAST, EFFICIENT PRODUCTION OF AIRCRAFT PARTS...



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Weldments "CAST-WELD" Design
ROLLS: Steel, Alloy Iron, Alloy Steel

• Another team of two BIRDSBORO Hydraulic Presses at work in North American Aviation Company.

It will pay you to find out why BIRDSBORO specialization in press design can help you get maximum production from your present plant setup . . . or make your new plant a model of efficiency.

HP 15-54

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BIRDSBORO STEEL FOUNDRY & MACHINE CO., BIRDSBORO, PENNA. Offices in Birdsboro, Pa. and Pittsburgh, Pa.

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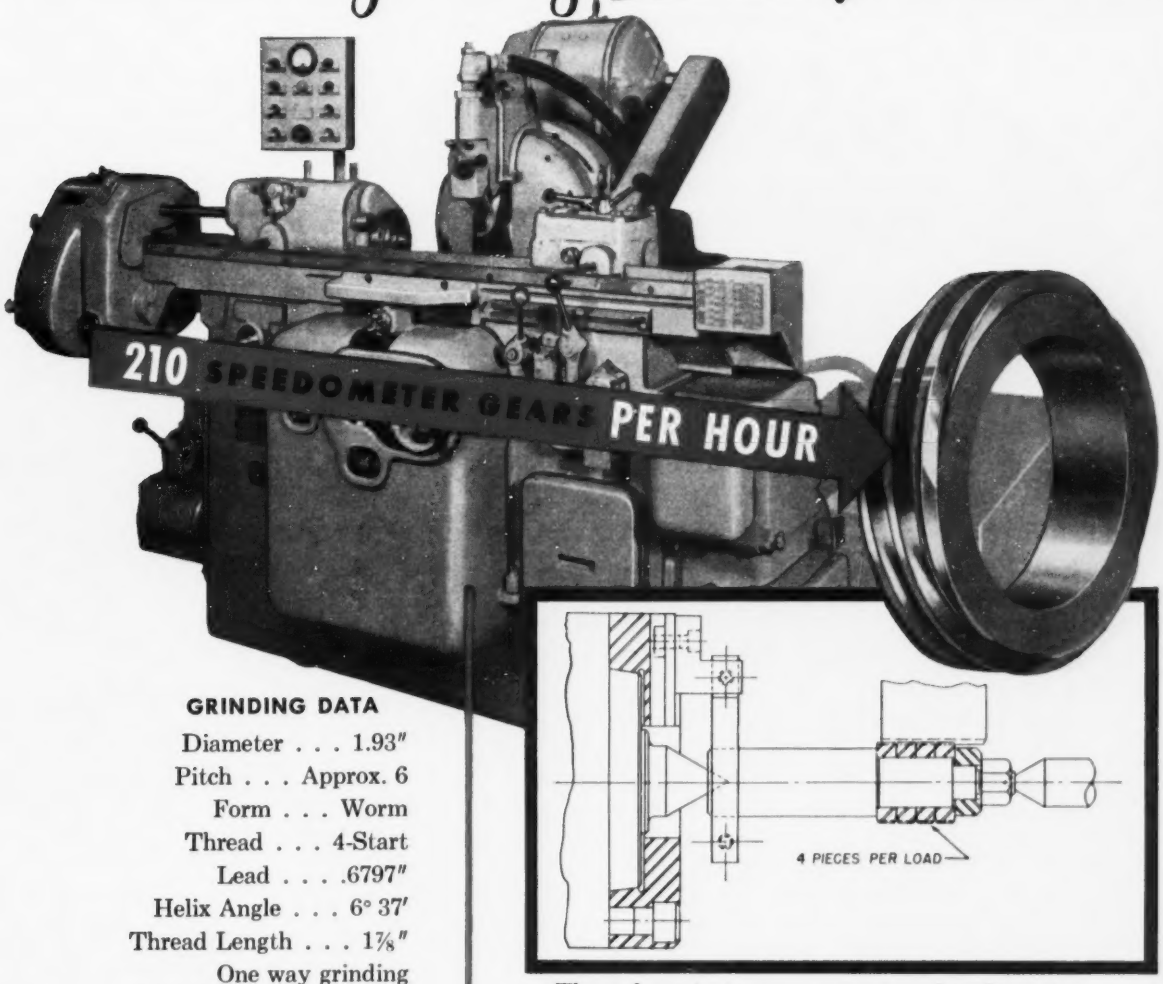
Multi-ribbed grinding BOOSTS production!



GRINDING DATA

Diameter . . . 1.93″
Pitch . . . Approx. 6
Form . . . Worm
Thread . . . 4-Start
Lead . . . .6797″
Helix Angle . . . 6° 37′
Thread Length . . . 1⅞″
One way grinding
Stock removed . . . .089″
Crush Dressing of Wheel

AUTOMATIC WORK CYCLE

Automatic In Feed
Automatic Sizing
Automatic Wheel Trueing
Automatic Lubrication
Automatic Coolant System

These four-start worms are ground — four at a time in a single pass — from the solid. A multi-ribbed wheel is crush-dressed every 48 pieces (twelve arbor loads). The finish on these parts — and the rate of production — exceed those possible by any other methods.

This is a typical example of how the FULLY AUTOMATIC WORK CYCLE of Jones & Lamson Automatic Grinders assures rapid metal removal, accuracy of form and quality of finish.

P.S.

Because of today's challenge for increased production at a higher degree of accuracy, Automatic thread and Form Grinders are replacing other methods for producing this class of work.

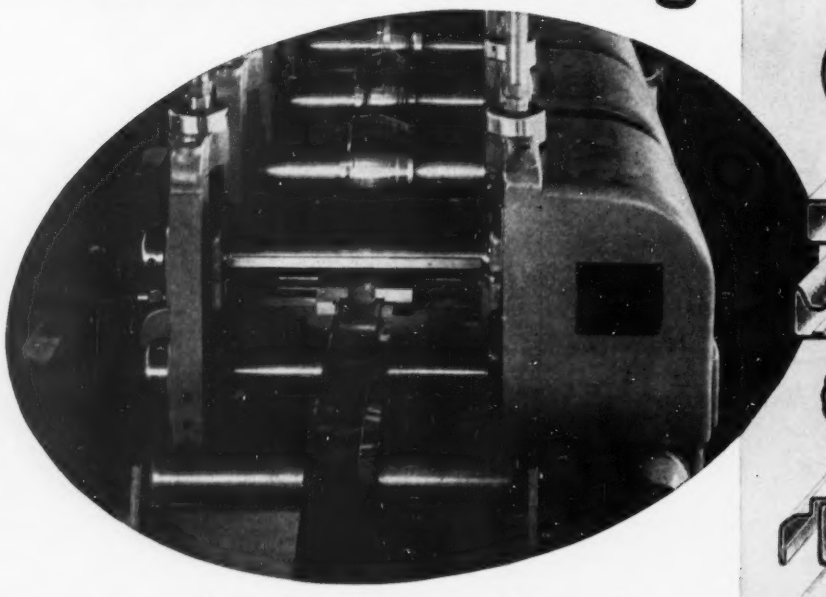
On the basis of increased quality and *more production per labor hour*, we invite the opportunity to improve upon your existing methods.

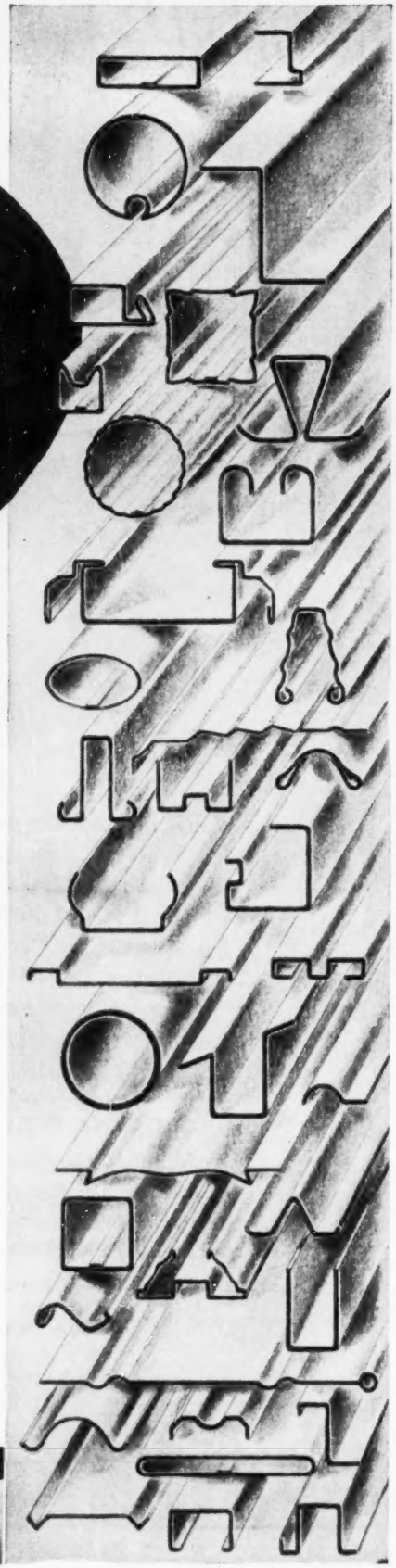
JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 512 Clinton St., Dept. 710, Springfield, Vt., U.S.A. J&L **MACHINE TOOL DIV.**

Cold-Roll-Forming





for *higher production,* at greatly reduced cost

If you make anything that can be cold-roll-formed in fair quantities, you may be sure it will mean either higher production or greatly reduced cost, or both. Moreover, because roll-formed shapes can be designed for highest strength-weight ratio, this method often affords material savings exceeding the entire conversion cost.

There may be some operation in your plant where cold-roll-forming would prove more economical than present methods; or you may be buying components made by other methods, which you could make yourself at greatly reduced cost. Sometimes other operations, such as curving, coiling, embossing, perforating, welding, etc., can be combined with roll-forming at little or no extra cost. In any case, feel free to consult Yoder engineers as to practicability and cost of applying a cold-roll-forming machine to any operations you have in mind.

The Yoder Book on Cold-Roll-Forming may prove of interest to you. It's yours for the asking.

THE YODER COMPANY • 5504 Walworth Ave. • Cleveland 2, Ohio

Complete Production Lines

- ★ **COLD-ROLL-FORMING** and auxiliary machinery
- ★ **GANG SLITTING LINES** for Coils and Sheets
- ★ PIPE and TUBE MILLS - cold forming and welding

ENGINEERING YODER MANUFACTURING

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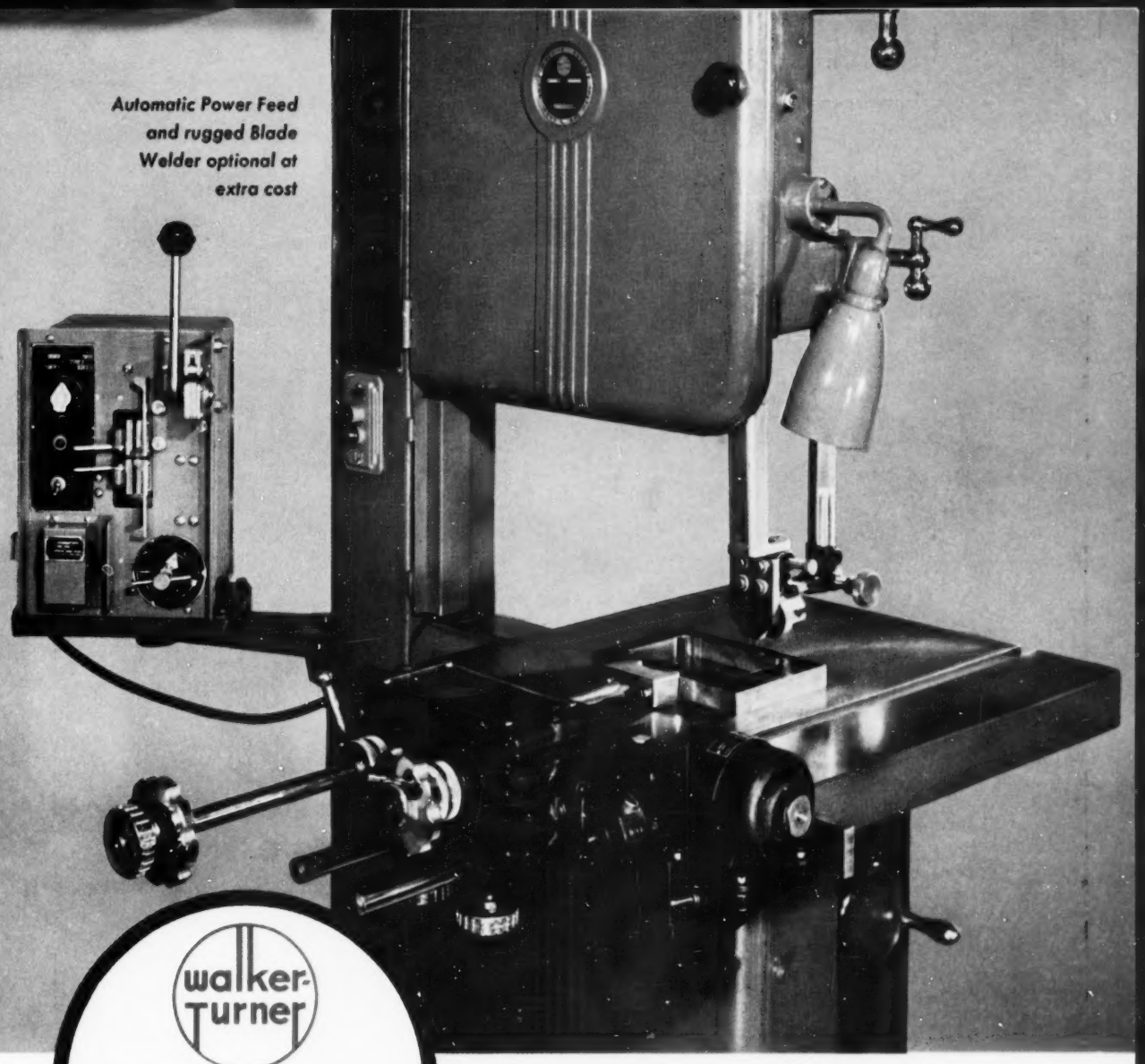
Automatic Power Feed and rugged Blade Welder optional at extra cost



walker-turner

Variable Speed Drive

cuts anything that can be cut

50 TO 4500 SURFACE FEET PER MINUTE

A turn of the handwheel – while the machine is running – sets blade speeds ***in stepless variation from 50 to 450 SFM in low range, or 500 to 4500 SFM in high range.*** Indicator registers exact speed.

The Walker-Turner 16" Variable Speed Band Saw cuts as you want it to cut. Always on the job, this LIGHT-HEAVYWEIGHT is easily set at exactly the right speed for any stock you work: tough steel... non-ferrous metals... plastics... wood. No time lost in belt changes, no efficiency lost because of inadequate speed range. See this versatile precision tool with *Variable Speed Drive* at your Walker-Turner distributor now.

There is much more to this Walker-Turner LIGHT-HEAVYWEIGHT story that our factory-trained distributor in your area would like to tell you. You will find him an expert on industrial equipment, a good man to know. And he's as near as your phone. So why not call him, or write us for his name and more information–today!

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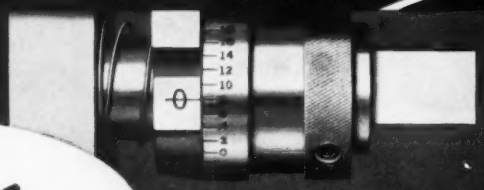
Wood and Metal Cutting BAND SAWS • TILTING ARBOR SAWS
RADIAL SAWS • JIG SAWS • LATHES • SPINDLE SHAPERS • JOINTERS
BELT AND DISC SURFACERS • FLEXIBLE SHAFT MACHINES



blade clearance indicator

. . . precise adjustment, easily and quickly made by the operator, gives correct blade clearance for any gauge or type of metal, minimizes burrs and greatly prolongs blade life.

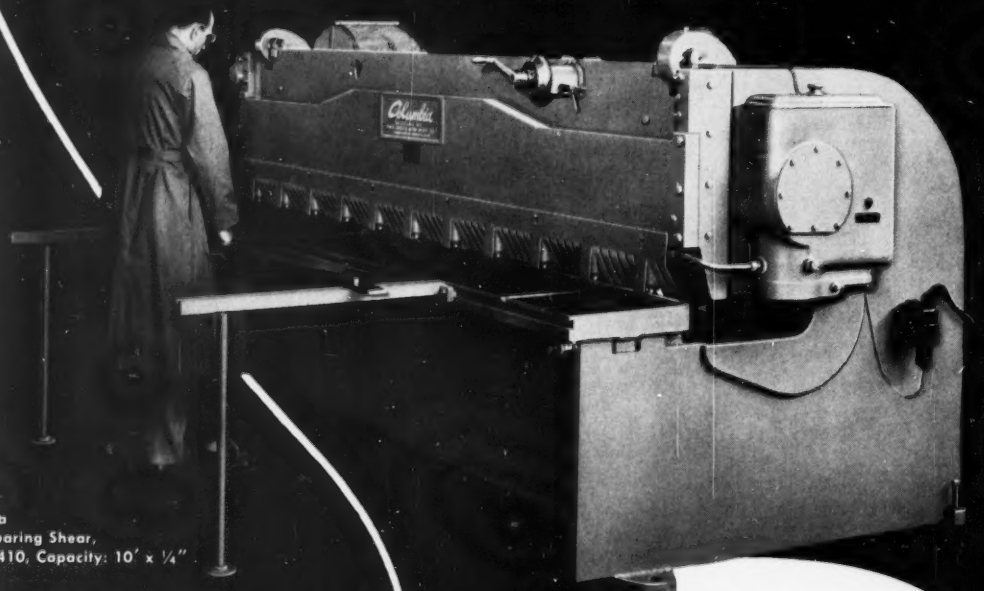
another **Columbia** shear feature

quick-set blade clearance adjustment

Columbia "New Series" steel squaring shears have many features specifically designed and refined to give low-cost, trouble-free operation.

The Blade Clearance Indicator, for example, lets the *operator* adjust blade clearance quickly and easily. This feature eliminates waiting for supervisory personnel, gives burr-free shearing on any gauge metal and significantly increases blade life.

Other Columbia features you should know about include the exclusive air clutch, hydraulic hold-downs, jog control for ram and others. Combine these with basic rigidity, rugged mechanism and long-lasting accuracy and you have the answer to low-cost shearing . . . the Columbia "New Series" Shear.



Columbia
Steel Squaring Shear,
Model 0410, Capacity: 10′ x ¼″

Other exclusive Columbia features are explained in detail in ***FREE*** *Bulletin No. PS-1. Write for it and the name of your Columbia distributor today!*

Columbia Division, The Lodge & Shipley Co.
Hamilton 1, Ohio

new series **Columbia** STEEL SQUARING SHEARS and POWER PRESS BRAKES

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SPEED

A well hit golf ball travels fast — 135 m.p.h.! The R and L TURNING TOOL is fast too — can be changed from right to left in 10 seconds.

14 TOOLS IN ONE

Does the job of fourteen tools . . . it's the only tool of its kind on the market. Drilling and turning; turning; centering and burnishing; pointing and form turning; drilling and chamfering; pointing . . . The R and L TURNING TOOL performs all these jobs. It is constructed of tough, heat-treated alloy steel . . . guaranteed not to bend or give way.

Write for Catalog

RIGHT R and L LEFT TOOLS

1825 BRISTOL STREET • PHILADELPHIA 40, PA.

TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO AVAILABLE FOR ACORN DIES) • UNIVERSAL TOOL POST • TURRET BACKREST HOLDER • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

Nichols TOOL ROOM MILLER

Accurate
Sensitive
Versatile

A compact, rugged miller that gives the tool room what it demands—extreme accuracy and utmost flexibility. The NICHOLS TOOL ROOM MILLER is arranged for sensitive hand screw feed. It has generous table surface of 8½" x 30", with 19" longitudinal travel. Precision feed screws are fitted with oversize, easy-reading micrometer dials. Large hand wheels provide the element of "feel" so important in precision milling. Rise-and-fall spindle enables easy handling of many difficult operations—increases usefulness—simplifies set-ups. Readily available are dividing head, vertical attachments, vises, and a full line of milling accessories. Priced surprisingly low. Descriptive literature sent on request.

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NATIONAL DISTRIBUTORS

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76-E MAMARONECK AVE • WHITE PLAINS, N. Y.

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There are lots of ways to

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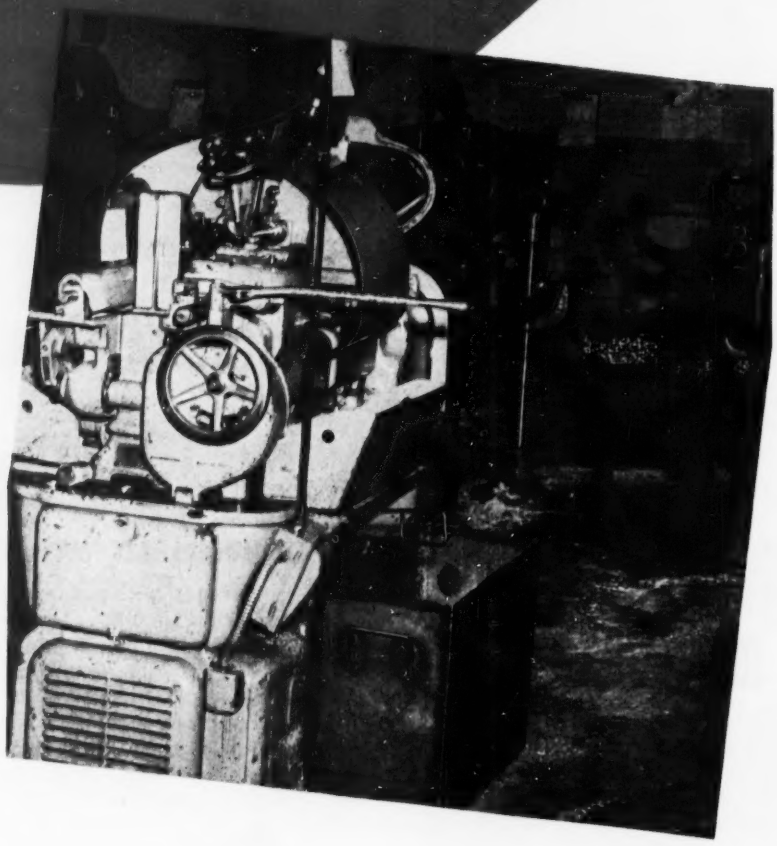

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By LORING F. OVERMAN

The Defense Materials System Revised

THE long-awaited revision of the Defense Materials System was announced in Washington late in March, after being previewed by the Cabinet and approved by the Defense Department. The revision is planned as a major simplification of defense priority regulations, and the new version is expected to remain in effect at least until June, 1955. At that time, the Defense Production Act will expire, unless extended.

Under the Defense Materials System which replaced the Controlled Materials Plan last summer, producers were no longer required to file reports on their use of steel, copper, and aluminum. The manufacturers of "B" products for the military were permitted to self-certify their requirements for controlled materials. Only the manufacturers of "A" products—tanks, ships, aircraft, and other items entirely military—were required to submit advance estimates of their own requirements, and those of their subcontractors.

The New Defense Materials System

The new and simplified DMS procedure has two purposes. The first is to ease the bookkeeping burden of contractors serving the military. The second is to keep in working order a reporting system which could be expanded quickly in the event of a new emergency. The new rules (available in detail from the Business and Defense Services Administration, Washington 25, D.C.) provide that prime contractors for "A" products will not be required to gather materials requirements from subcontractors, and then pass allotments and production schedules all the way down the line. Instead, they need account for only 85 per cent of their allotments—the needs of their own plant and that of the first echelon of subcontractors.

Surveys made by the Defense Department are understood to have revealed that by far the greatest percentage of metal used on a contract is required by the few contractors in the upper levels of the job. Such a concept relieves hundreds of small contractors from reporting requirements for small parts of planes, tanks, ships, and so on, but permits planners to keep a fairly accurate check on all metals needed by knowing about the 85 per cent.

Plant Expansion Continued

The new DMS rulings should be of interest to the 4000 or more plants that plan to expand their facilities in fiscal 1954 in order to participate in defense contracts. The figure of 4000 came in for some discussion before the House Appropriations Sub-committee recently when the Department of Defense indicated that it will be required to process this number of applications for rapid tax amortization. Members of Congress seemed somewhat surprised at so large a total, in view of cutbacks announced or contemplated.

Defense Department spokesmen pointed out that 9100 applications were processed during the current fiscal year. They explained that ninety expansion goals remain open, requiring further facilities, including both construction and equipment.

Meanwhile, the Senate Interior Committee has been studying the problem of strategic materials. Committee members indicated that they favor taking whatever steps may be necessary to bring about an improvement. Committee Chairman Malone observed that high productive capacity is one of our most strategic weapons, but is dependent on adequate supplies of materials.

In addition to the foregoing projects, which are certain to involve large quantities of machinery of many types, another Defense Mobilization procedure (DMO VI-4) has a bearing on the machinery industries. This is an official Defense Mobilization Order to encourage "protective construction" for the nation's productive facilities. The order promises accelerated tax amortization and inducements for attack-proofing manufacturing plants.

Surplus Disposal Studied

Second only to the question of whether there will be an ample backlog of orders for new equipment is another—"What will be the market impact of huge surpluses?" Defense Mobilization Order (DMO V-3) outlines a policy that Defense Mobilization Director Arthur S. Flemming believes will not affect markets adversely, at least to any great extent. The policy provides that surpluses first be used to supply unfilled needs in the national defense stockpile. If stockpile goals are filled, the surpluses will be held by the Government for eventual disposal. Sales will require the approval of the President, and will be conducted only after public announcement.

Small Business Encouraged

An important Military Department Order No. 4100.9 reaffirms the policy of the Pentagon "to obtain for small business concerns the greatest practicable participation in the defense procurement program, both through prime contracting and through encouragement of subcontracting." However, Assistant Defense Secretary Charles S. Thomas explained that the primary consideration "shall be that of securing performance or deliveries at the time, in the quantity, and of the quality required for the defense program."

Under the new basic policy, the Small Business Administration may assign one or more representatives to contracting offices of the military departments. These offices will afford small business specialists an opportunity to join in screening all proposals (except classified projects) to determine whether small business firms are qualified to bid. In some instances, bidding will be limited to small business firms, but the Services reserve the right to reject bids if they feel it to be in the best interest of the Defense Program.

REPRESENTATIVES of both big and little business should be interested in proposed legislation recommended by the Commerce Department. In hearings before the House Judiciary Sub-committee, the Commerce Department favored a bill to require registration of persons selling to the Government on a commission basis, but exempting salaried personnel of manufacturers and commercial agencies.

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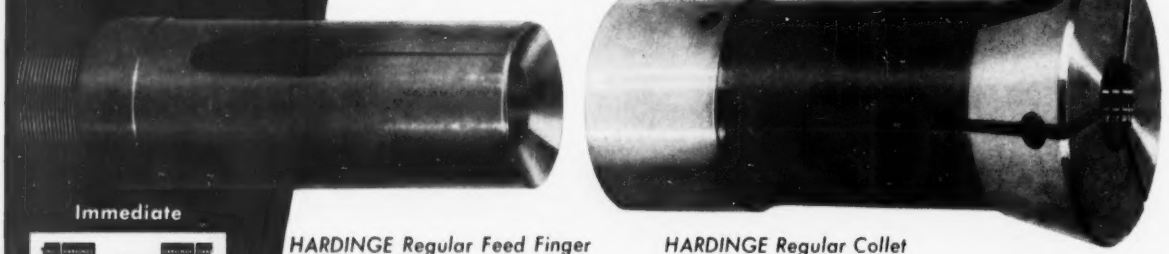

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MACHINERY
MAY 1954

It Pays to Use Standard Commercial Parts

STANDARDIZATION has been a powerful factor in the development of American industry to its high production level. Immeasurable benefits have accrued to the metalworking industry through the adoption of dimensional and design standards for innumerable machine components. Think of the confusion that would exist today if screw threads, gear teeth, splines, and other elements of design were left to the whims of the individual drafting department!

There are, however, many concerns which do not take full advantage of the standardized parts that are commercially available, and frequently make in their own shops components that could be bought far more economically on the open market. Up to a short time ago, one concern made a special stud for its own use at a cost of $27 per 1000 studs. While paging through a technical magazine, one of the firm's engineers came across a stud commercially available which would be equally suitable for the required service and could be purchased at a cost of only $14 per 1000 studs. Savings—48 per cent.

Today, standard parts can be bought for jigs, fixtures, and dies that were formerly made by individual tool-rooms. Because drill bushings, dowel-pins, clamps, and punches are produced by specialist concerns on a quantity basis, they can invariably be bought at considerably less than it would cost to make only one or two at a time. The cost-conscious tool designer will modify his drawings whenever possible so as to enable the use of commercially available standard parts.

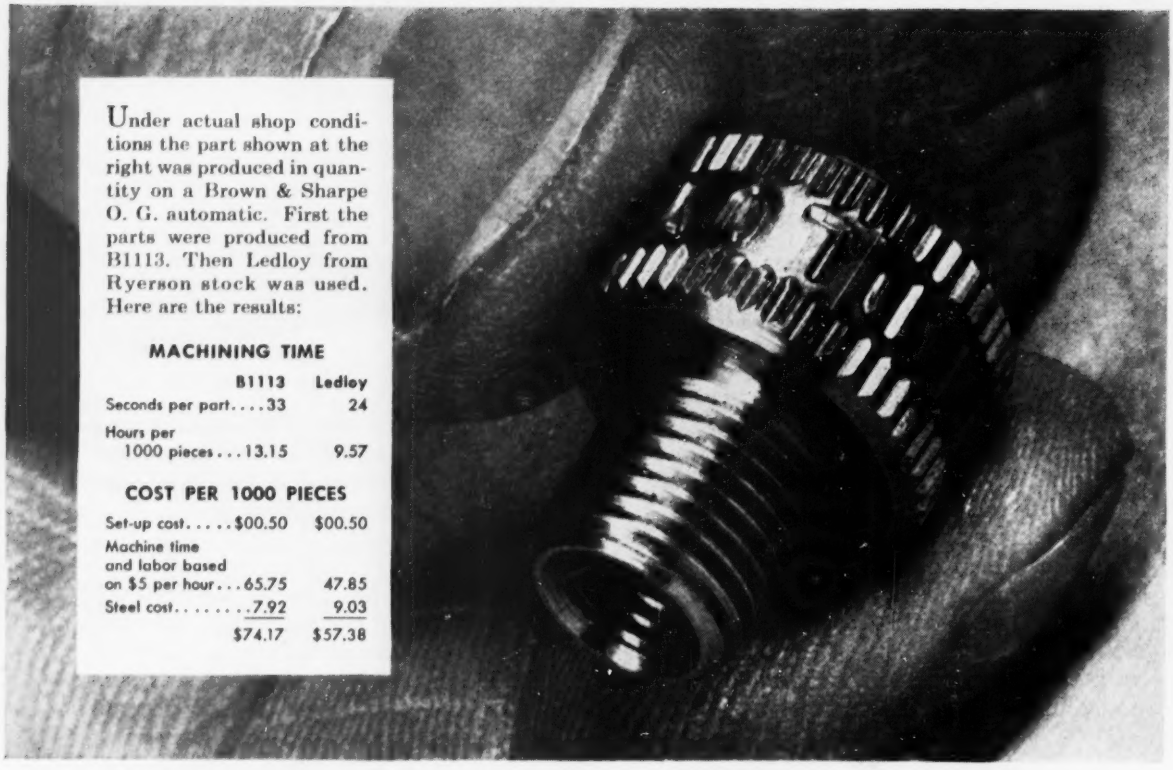
Much time can be saved in the drafting-room by specifying standard parts, since the making of many detailed drawings is eliminated. Design problems are frequently simplified, as for example when a standard clamping device can be employed on some jig or fixture. To design a special clamp might entail hours of time. Also, many advantages can be derived from the adoption of a tool standardization program.

Many shops customarily develop their own standards for parts that they themselves make. In such cases, the wise policy for the engineering department is to consult with the production executives to insure the development of the most economical design from the manufacturing standpoint. It must be remembered that the standard part will be made time and again, and therefore should be carefully analyzed to insure that cost will be as reasonable as possible in line with required quality.

Standardization of machine and tooling components—whether for manufacture in the user's shop or for purchase on the market—eliminates many production problems, decreases costs, and reduces maintenance.

Charles O. Herb

EDITOR



Under actual shop conditions the part shown at the right was produced in quantity on a Brown & Sharpe O. G. automatic. First the parts were produced from B1113. Then Ledloy from Ryerson stock was used. Here are the results:

MACHINING TIME

	B1113	Ledloy
Seconds per part	33	24
Hours per 1000 pieces	13.15	9.57

COST PER 1000 PIECES

Set-up cost	$00.50	$00.50
Machine time and labor based on $5 per hour	65.75	47.85
Steel cost	7.92	9.03
	$74.17	$57.38

$16.79 saving on 1000 parts using Ledloy from Ryerson

In shops throughout the country Ledloy is effecting similar savings—establishing its superiority over all other free-machining steels. Since switching to Ledloy, one shop reports an increase in production of 54%; another 43%; still another 75%!

On the average, this remarkable lead-lubricated steel brings net savings of 25% or more everywhere it is used by permitting much faster feeds and speeds (25 to 50% faster than B1113) and by extending tool life as much as 200%. Still Ledloy retains the strength and other good qualities of an open hearth steel. Machines to an unusually clean, smooth finish—bends, crimps, swedges or rivets easily.

You can get quick shipment of Ledloy in any quantity from your nearby Ryerson plant. Rounds, squares and hexagons are immediately available in a wide range of sizes. And your Ryerson representative will be glad to give you all the engineering data on this remarkable free-machining steel. We suggest you order a trial quantity now.

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Fabricating Stainless-Steel Tanks for Liquid Storage

By
Raymond H. Spiotta
Assistant Editor

MACHINERY, May 1954
Volume 60—Number 9

Tanks designed for the sanitary storage of hot or cold liquids and semi-liquids are constructed from stainless-steel sheet at the Little Falls, N. Y., plant of the Cherry-Burrell Corporation. Inert-gas and submerged-arc welding and the use of a great number of portable electric tools insure rapid production.

TANKS in which milk, juices, pharmaceutical liquids, and other fluids are to be stored, and sometimes refrigerated, must meet rigid specifications with regard to materials and fabrication. This is necessary in order to effectively guard against contamination due to leakage or chemical action. All-welded stainless-steel tanks built by the Cherry-Burrell Corporation meet these requirements.

The tanks are constructed with a corrosion-resistant inner lining. One feature of this lining is a unique "cold wall" construction consisting of individual channels welded to a backing plate to form circulating tubes for the refrigerant. This cold wall may run completely around the tank or around any portion of it, depending on the specific requirements of the unit. The channels extend around the periphery of the tank lining and terminate in two header tubes which connect the open ends of all the channels at each side.

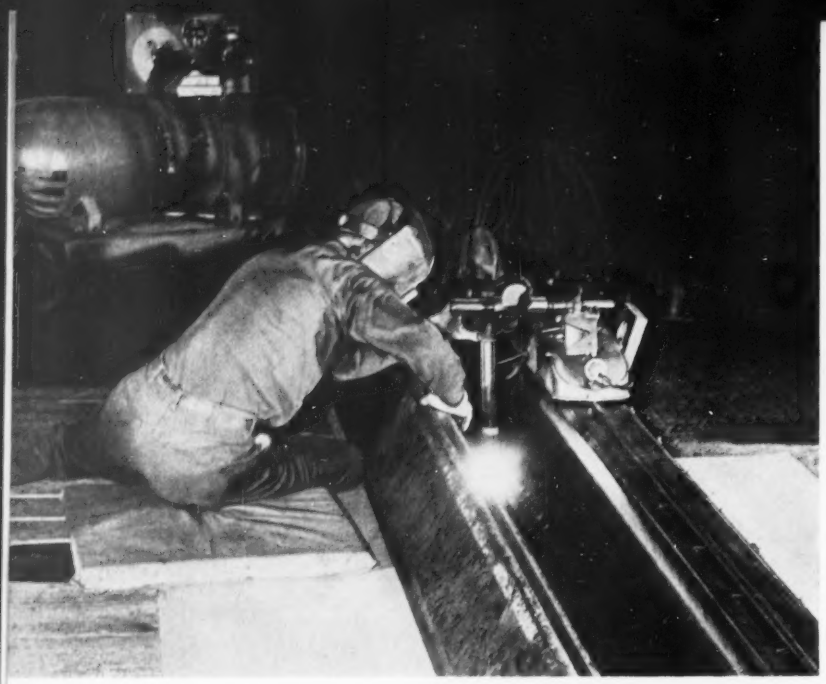


Fig. 1. Stainless-steel backing plate is welded in this inert-gas metal-arc welding machine. An operator checks the progress of a hydraulically driven traveling head. A 200-ampere, 40-volt Lincoln generator supplies the necessary power.

Pre-cut sheets of 10-gage AISI Type 304 stainless steel are butt-welded together to form the backing plate. A special inert-gas metal-arc welding machine, shown in Fig. 1, is used for this operation. It is powered by a 200-ampere, 40-volt Lincoln generator. The sheets are inserted between two rails and located against stops where they are clamped in position. A Linde "Oxweld" traveling head floods the molten area with a chemically inert blanket of helium gas as it moves across the length of the seam.

More than 200 lightweight, yet powerful, portable electric tools are in service at this plant. One of the "Hicycle" grinders is shown in Fig. 2 being applied to the butt-welded seam of the backing plate. These tools, manufactured by the Chicago Pneumatic Tool Co., operate on 220-volt, three-phase, 180-cycle current, which is supplied by a General Electric 25-K.V.A. motor-generator set. Provided with such a variety of tools, the worker can select the right tool for the right job.

Fig. 2. Portable electric grinders are used to finish the butt-welded seams of the backing plates flush. In this view a worker is shown using one of the more than 200 Hicycle electric tools that are employed in the plant.

Fig. 3. Individual channels are placed in the clamping fixture of a submerged-arc welding machine. Before each run, a test specimen is welded, sectioned, and etched to check the penetration of the weld. In this way uniformity of the joints is assured.

After the excess weld is ground from the seams, they are polished to a 180 grit finish on the side that is to form the inner surface of the lining. The seams on the outer side are polished flush.

Construction of the cold-wall surface begins with the tack-welding of the center refrigerant channel to the backing plate. Manually operated clamps hold the plate in position on the feed table of the specially constructed submerged-arc welding machine seen in Fig. 3. A second channel is lined up adjacent to the first and secured in place by a double locking fixture which forms a part of the welding machine body. There is a safety device on the far end of the machine to prevent the hydraulic locking fixture from accidentally closing while the operator's hand is inserted.

An electropneumatic power drive is utilized to feed a Lincolnweld head along rails at a speed of 102 inches per minute. The weld is made within a V-shaped trough formed by the two sides of the clamping fixture. This trough, together with the welding head, is shown in Fig. 4.

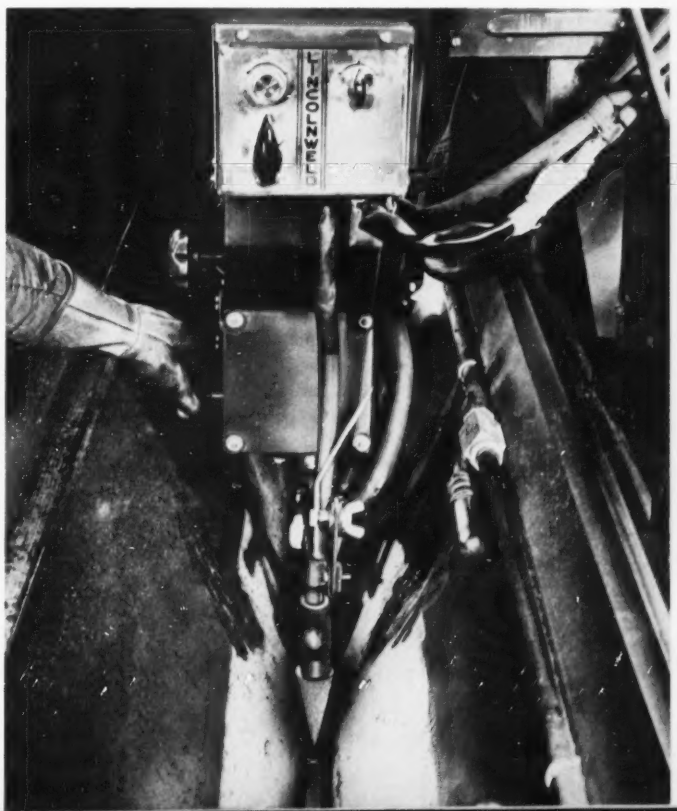


Fig. 4. The submerged-arc welding head is guided on rails along a V-shaped trough at the base of which are clamped the channels to be welded. The head is hydraulically actuated. An electrode wire 3/32 inch in diameter is used.

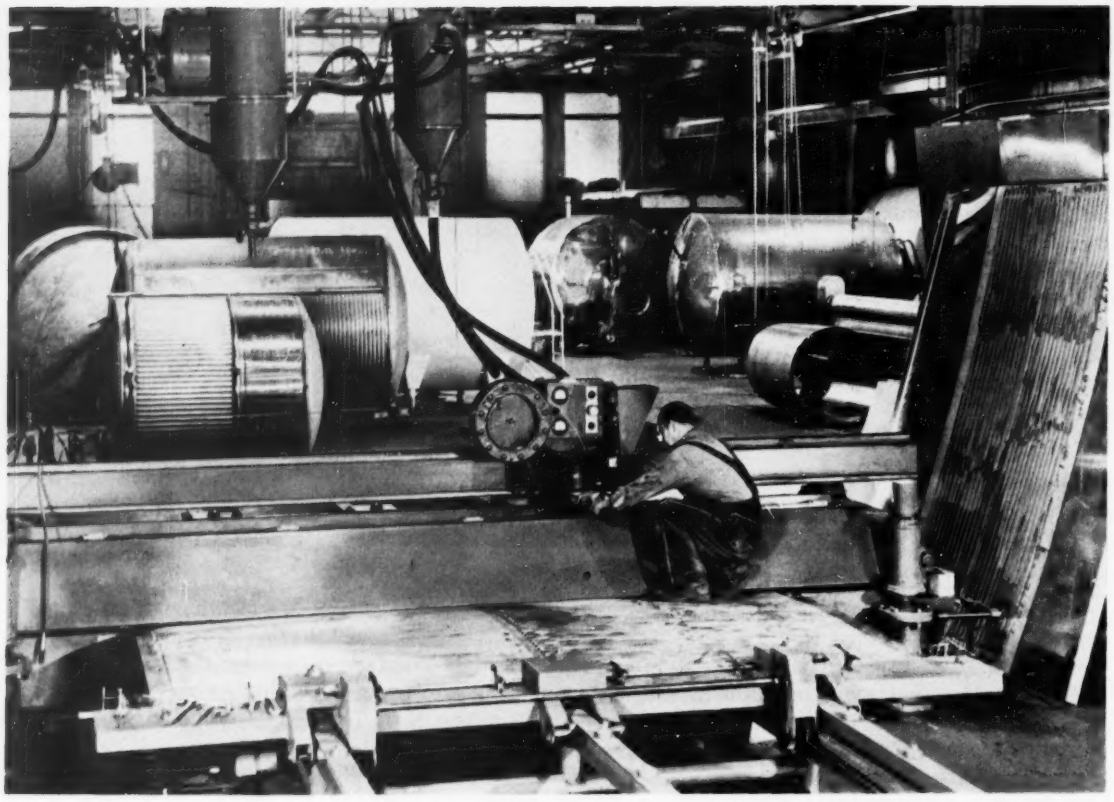


Fig. 5. General view of tank shop showing partially completed tanks in background. Submerged-arc welding of cold-wall section is being performed in foreground.

Electric lights installed along the upper edge of one side of the vee illuminate the operation. A 3/32-inch diameter Type L 18-8 electrode wire is used. Electric power is supplied by a 600-ampere, 40-volt Lincoln generator which is adjusted to deliver 440 amperes at a pressure of 31 volts for this operation.

An electric gear-driven mechanism indexes the feed table a distance equal to the width of one channel each time a button is depressed. The plate is fed and the channels welded from the center to one end, after which the procedure is reversed. This tends to equalize any stresses or warpage that may have been set up in the metal. An over-all view of the operation may be seen in Fig. 5. The welded section is shown emerging from the machine in Fig. 6. Separately mounted balls, such as those seen on the table frame in the illustration, provide the contact surface over which the plate rides during feeding. After welding, the brittle coating of flux is removed with a 6-inch diameter wire wheel held in a Hicycle grinder.

Quality control is employed to maintain a constant check on this phase of production. Before each run, a test section is welded. This section is cut apart and the weld area etched. In this way, consistent penetration is assured.

Completion of the developed blank for the inner lining is accomplished by welding 12-gage sheets of the same type of stainless steel to both ends of the cold-wall section. The inert-gas welding machine that was used for building up the backing plate is employed for this operation. After welding, the seams are cleaned up by using portable electric polishers and Lea polishing compound.

A 16-foot Bertsch roll is used to form the sub-assembly to the required diameter. This machine is capable of handling hot-rolled steel sheets up to 1/4 inch in thickness. The weldment is fed between the two front rollers, as illustrated in Fig. 7, then deflected upward by an adjustable rear roller, thus imparting the desired curvature to the work-piece. A bar suspended overhead supports the plate as it leaves the rolls, while a second bar supports the straight portion. This second bar is elevated to facilitate feeding, Fig. 8.

The entire cold-wall area is polished with a 180 grit compound, first with a sewn cloth wheel, then with a loose cloth wheel. Brown

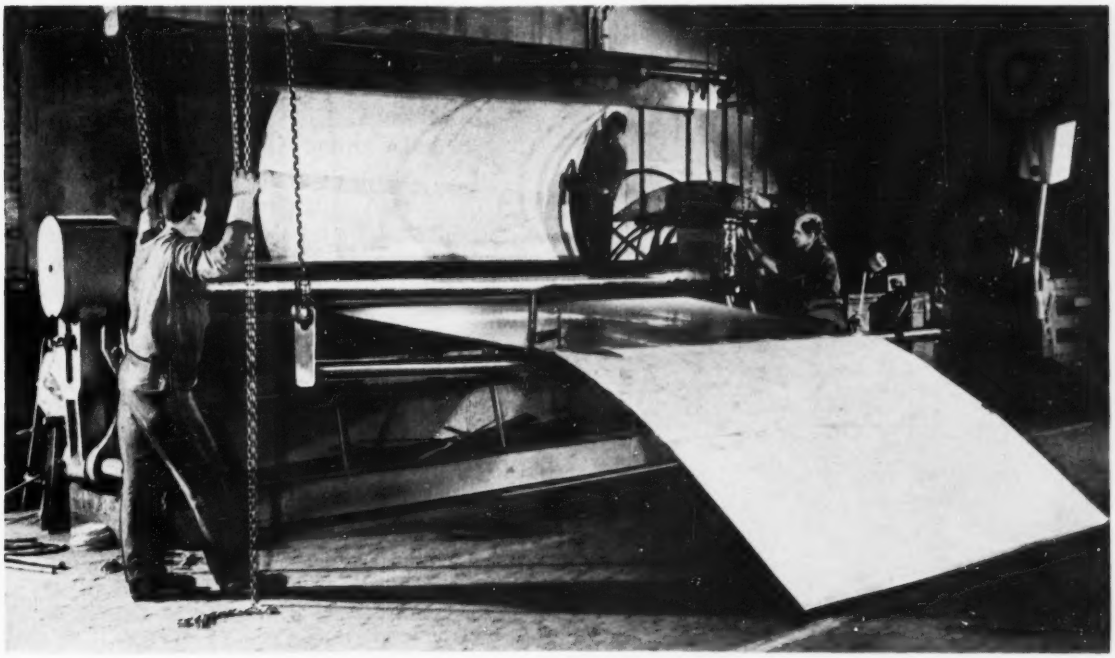
Fig. 6. After each weld is completed, the table is indexed the width of a single channel semi-automatically. A cold-wall section is shown emerging from the welding machine.

kraft paper is applied to this concave surface with Paisley paste, following which the seams are covered with adhesive cloth. This is to protect the surface from abrasion or other damage during final assembly.

Deep-spun stainless-steel heads make up the end members of the inner lining. The heads are spun and polished at the Utica Steam Engine & Boiler Works, Fig. 9. After being received at the Cherry-Burrell plant, the head destined for the front of the tank is laid out and a manhole opening is cut. Other openings are shown being roughed out with a hand-held grinder in Fig. 10. Reinforcing rings are tack-welded to the spinnings to supply rigidity during assembly. The inner surfaces of the heads are then lined with asbestos paper to protect the polished surface.

Assembly of the heads to the lining is facilitated by the use of a Ransome fixture, which consists basically of two sets of motor-driven

Fig. 7. Bars suspended overhead support both ends of the lining as it is fed through 16-foot rolls.



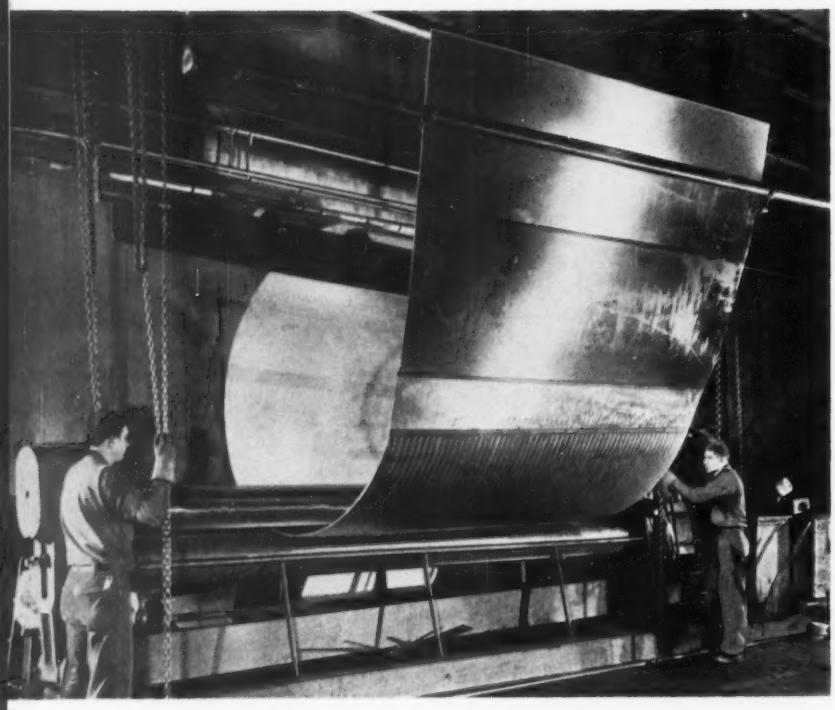


Fig. 8. After lining is started through the rolls, the bar supporting the straight end is elevated to facilitate feeding.

rollers mounted in two V-shaped castings. The fixture is designed to support the lining at both ends and to roll it about its longitudinal axis for ease in welding the seam. As the lining body is wrapped around the heads, tack welds are made along the seams. An overlap remains when the wrap-around is completed. This is cut off with a Stanley No. 208 "Unishear." The joint is also tack-welded.

An inert-gas arc-welding gun, which is held by hand, Fig. 11, is employed to complete the joining of the tacked seams around the heads and along the lining joint. Filler rods are used in these external operations. Inside the tank lining the head joints are welded in the same manner except that welding guns with consumable electrodes are utilized. A flexible vacuum line is inserted through the manhole to remove generated gas and circulate fresh air. When all this has been completed, the reinforcing rings are cut off.

Necessary outlets and fittings are fastened to the heads by ordinary metallic arc-welding methods. Two header tubes are welded in place,

Fig. 9. Stainless-steel heads for the inner lining of the tanks are being polished subsequent to spinning. This operation is carried out at the Utica Steam Engine & Boiler Works.

Fig. 10. Operator is shown using a Hi-cycle portable grinder to rough out required openings in a spun head.

one over each set of cold-wall refrigerant tube ends. After this, the top seam, head seams, and outlet joints are ground and polished with Lea compound, as shown in the heading illustration. All tools, wheels, and grit are removed from the lining, together with the paper and adhesive cloth protective coverings.

Pressure testing for leaks due to faulty welds follows. An air test is performed in which the tank lining is pressurized until 5 pounds per square inch is attained. While this pressure is held, a heavy soap solution is applied to all seams and joints. The formation of bubbles would indicate points of leakage.

Thorough solvent cleaning of all cold-wall manifold parts precedes hydrostatic testing. Water is pumped into this section under a pressure of 350 pounds per square inch while careful inspection is made for possible leaks. After the test has been satisfactorily completed, the water is drained out and an air hose attached to each header tube to insure adequate drying. Protective caps are placed over the open tubes to prevent the entrance of any moisture or foreign matter. This hydrostatic test is followed by another test employing ammonia. Testing with

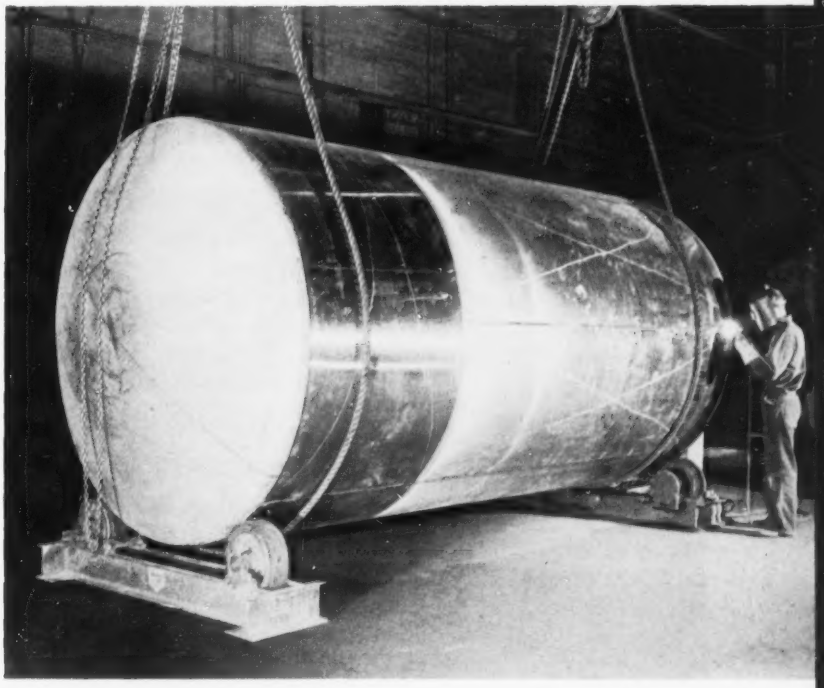


Fig. 11. Previously tacked seams are finish-welded with an inert-gas arc-welding gun. Filler rods are fed into the weld zone.

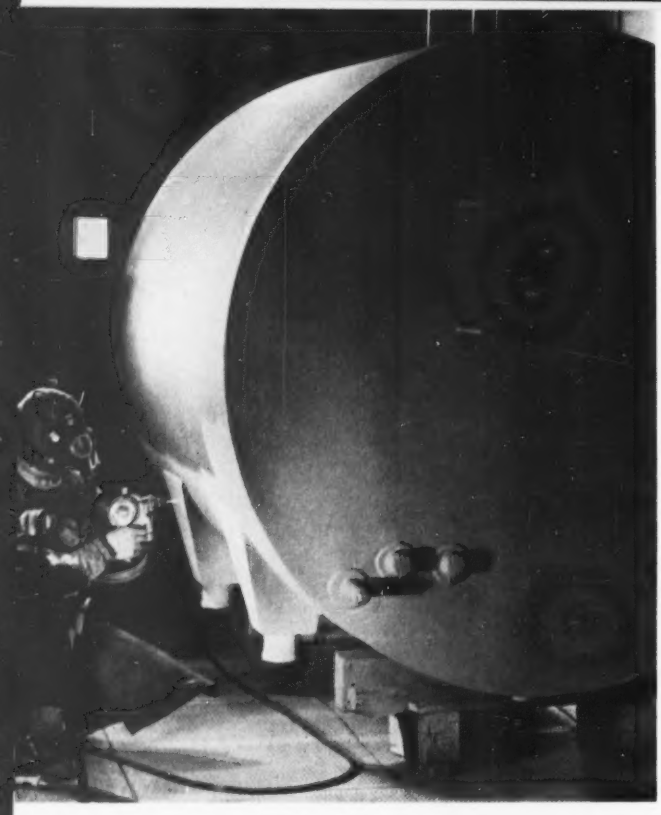


Fig. 12. When a high degree of corrosion resistance must be provided, the tank is sprayed with metallic zinc prior to the application of a finish coat of paint.

ammonia will reveal leaks that may not be detected by either air or hydrostatic testing.

Each lining assembly is completely insulated to aid in the economical refrigeration of the finished storage tank. First the cold wall is sprayed with "Insul-Mastic," a vinyl vapor-seal intended for thermal insulation. Then the complete lining is covered with a 2-inch thick layer of cork. Two rows of heavy wood planks are placed on each side of the lower portion to form a saddle for carrying the weight of the lining. Both the insulation and the planks are secured in position with steel straps. Rock wool batting is placed over both heads to insulate the space between the lining and the socket heads.

A jacket of 11-gage hot-rolled steel is built up in the same way as the lining body, and is rolled to shape. It is wrapped around the inner tank lining and lap-welded at the bottom. Reinforcing rings are welded inside the jacket at each end. Two spun hot-rolled steel heads are fitted to the jacket and seam-welded in place. Leg channels—the number depending on the size of the tank—are welded to the jacket in such a position that the weight of the unit will be transferred to the wooden support members that are secured to the lining. The addition of the required fittings completes the tank structurally.

Before applying the protective and finish coatings, the surface is prepared by sand-blasting, an operation utilizing Pangborn equipment. The tanks normally receive a base coat of zinc chromate primer, followed by a vinyl enamel finish coat.

In special cases where a high degree of corrosion resistance is required, a layer of metallic zinc is substituted for the zinc chromate primer. This is applied by a hand-operated metallizing gun, Fig. 12, which is fed with 1/8-inch diameter zinc wire. A finish coat of the same vinyl enamel is used over the zinc-sprayed tank.

Welding Titanium in an Inert-Gas Chamber

THE welding of titanium presents a variety of problems not generally encountered by metal fabricators. Among these, the most important is created by the fact that the weld and its adjoining parent metal sections require shielding from the atmosphere at temperatures above 1400 degrees F. The usual methods for fusion welding titanium have involved the use of Heliarc, argon-arc, or automatic methods.

In addition to studying these procedures for welding titanium, and the techniques for resistance welding, Arnold S. Rose and Morton A. Braun of the I.T.E. Circuit Breaker Co., Philadelphia, Pa., have developed the use of an inert-gas chamber of mild sheet steel. Shoulder-length rubber gloves sealed to the walls of the chamber permit the welding operator to manipulate the work and welding tools from the outside, while windows, made of ultra-violet absorbing Plexiglas, serve as viewing ports for the operator and observers. Torch, cables, and hose are introduced to the chamber through gas-tight connections. The entire chamber is sealed to the table of a conventional welding positioner.

The inert-gas atmosphere, usually high-purity helium, is introduced at the top of the chamber and quickly displaces the air through an open purging valve at the base of the chamber. This purging is continued until an uncontaminated weld bead can be made on a piece of scrap material. Freedom from oxidation is indicated when the weld bead is bright and silvery in color. This process is described in a recent issue of *Rem-Cru Titanium Review*.

One Machine Tooled Up for Five Different Housings

By F. D. Wallace, Vice-President
J. D. Adams Mfg. Co.

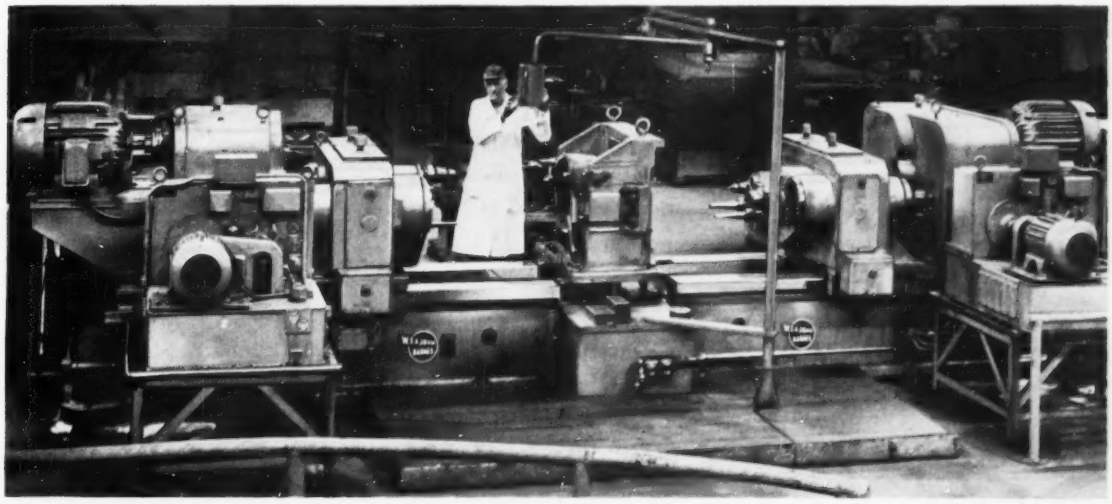
WHEN is it possible and profitable to use a special-purpose machine for borderline production jobs? What yardstick, rule, or formula can be applied, if any? Most master mechanics and production executives have pondered long hours over this perplexing problem without finding a short-cut method of determining what can or cannot be done with equipment to be designed and built for a specific job. It is only after the desired objectives have been well defined, and the problems thoroughly studied by experienced builders of special machinery in cooperation with production men and engineers in the plant where the equipment is to be used, that definite conclusions can be reached.

The advantages that can often be derived from the intelligent study of a production problem are exemplified by a special machine recently installed in the plant of the J. D. Adams Mfg. Co., Indianapolis, Ind., builder of heavy-duty motor-driven road graders. This special-purpose machine, equipped with flexible fixtures and tool-heads, handles five different transmission housing components. A considerable variety of boring operations is performed with the speed, accuracy, and economy generally inherent in a special machine.

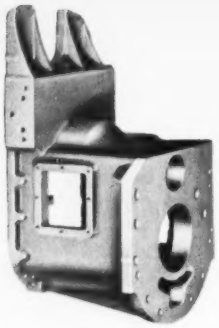
The machine, which was designed and built by the W. F. & John Barnes Co., is shown in Fig. 1. It handles the lower transmission case, the intermediate plate, the upper transmission case, the upper transmission case cover, and the final-drive housing for the grader transmission housing. A total of fifty-three operations are performed on the five work-pieces by tools on right- and left-hand horizontal heads and by two auxiliary spindles. Cycle times vary from fourteen to thirty-six minutes.

Multiple-purpose spindles in each tool-head are positioned to suit hole locations in the five work-pieces. The right-hand unit has seventeen spindles which, in most cases, bore several holes in the different work-pieces. For instance, spindle No. 2 on the right-hand head rough, semi-finish, and finish bores a hole 7.872 inches in diameter and cuts a groove to a diameter of 8.140 inches in the lower transmission case. The same spindle, equipped with different tools, rough, semi-finish, and finish bores a hole 6.127 inches in diameter in the intermediate plate; and rough, semi-finish, and finish bores a hole

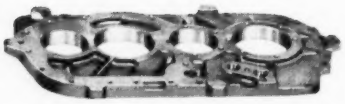
Fig. 1. Special machine tooled up to handle five separate housing parts for the Adams constant-mesh transmission



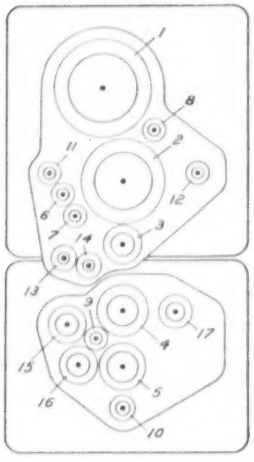
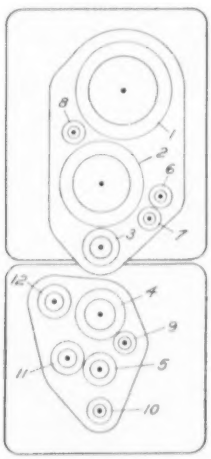
OPERATION SHEET SHOWING WORK PERFORMED ON FIVE PARTS

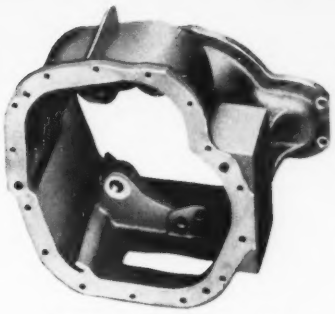


Lower Transmission Case



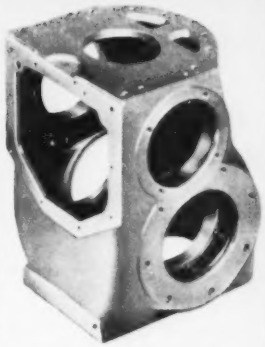
Intermediate Plate

Spindle Location	Spindle Number	Lower Transmission Case	Intermediate Plate
Right-Hand Head	1		
	2	Rough, semi-fin., fin. bore 7.8720—7.8731"; groove	Rough, semi-fin., fin. bore 6.127—6.125"
	3	Rough, semi-fin., fin. bore 4.3312—4.3300"; groove	Rough, semi-fin., fin. bore 5.1189—5.1179"
	4		Rough, semi-fin., fin. bore 6.300—6.2983"
	5		Rough, semi-fin., fin. bore 4.9221—4.9211"
	6	Semi-fin., fin. bore 1.254—1.251"	Semi-fin., fin. bore 1.254—1.252"
	7	Semi-fin., fin. bore 1.254—1.251"	Semi-fin., fin. bore 1.254—1.252"
	8		Fin. bore 0.624—0.626"
	9		Fin. bore 0.624—0.626"
	10		Fin. bore 0.624—0.626"
	11	Fin. bore 0.624—0.626"	
	12	Fin. bore 0.624—0.626"	
	13		Semi-fin., fin. bore 1.376—1.375"
	14		
	15		
	16		
	17		
Left-Hand Head	1		
	2		Chamfer
	3		
	4		Chamfer
	5		Chamfer
	6		Chamfer
	7		Chamfer
	8	Fin. bore 0.624—0.626"	
	9	Fin. bore 0.624—0.626"	
	10		
	11		
	12		
Auxiliary Spindles	1		
	2		



Upper Transmission Case

Upper Transmission-Case Cover



Final Drive Housing

First Operation	Second Operation	Third Operation	Upper Transmission-Case Cover	Final Drive Housing
				Rough, semi-fin., fin. bore 9.502—9.499"; chamfer; face
				Rough, semi-fin., fin. bore 8.752—8.749"; chamfer; face
			Rough, semi-fin., fin. bore 4.724—4.725"	
			Rough, semi-fin., fin. bore 4.3313—4.3303"	
Idle	Idle	Fin. bore 0.624—0.626"	Fin. bore 0.624—0.626"	
Idle	Idle	Fin. bore 0.624—0.626"	Fin. bore 0.624--0.626"	
Rough bore 2.8344"	Semi-fin. bore 2.8344"	Fin. bore 2.8344—2.8352'	Rough, semi-fin., fin. bore 3.937—3.936"	
Rough bore 2.8344"	Semi-fin. bore 2.8344"	Fin. bore 2.8344—2.8352"	Rough, semi-fin., fin. bore 4.3313—4.3303"	
Idle	Semi-fin. bore 1.002"	Fin. bore 1.002—1.005"		
				Rough, semi-fin., fin. bore 9.502—9.499"; chamfer; face
				Rough, semi-fin., fin. bore 8.752—8.749"; chamfer; face
Rough bore 5.515 and 5.1191"	Semi-fin. bore 5.515 and 5.1191"	Fin. bore 5.1191—5.1200"		
Idle	Idle	Fin. bore 0.624—0.626"		
Idle	Semi-fin. bore 1.501"	Fin. bore 1.501—1.502"		
Idle	Semi-fin. bore 1.002"	Fin. bore 1.002—1.005"		
				Fin. bore 0.624—0.626"
				Fin. bore 0.624—0.626"

Fig. 2. Close-up view of the fixture that holds the upper transmission case, showing how the fixture is provided with eyebolts for easy installation or removal

8.752 inches in diameter in the final-drive housing. The left-hand head, also a horizontal unit, contains twelve spindles.

Two auxiliary spindles incorporated in the locating fixture bore two dowel holes in the final-drive housing at right angles to the holes bored by the tool-head spindles. These auxiliary units are provided with self-contained drives. The tool-heads are hydraulically actuated and all movements of the machine are electrically interlocked for automatic operation.

Only four fixtures are required for the five housing parts, the intermediate plate and the upper transmission case cover being located in the same fixture. Each fixture is quickly interchangeable. Universal aligning pads are provided for locating each fixture precisely in place.

The tooling has been designed to insure minimum "down" time between change-overs. Each tool can be pre-set in its spindle through the use of special gages. With this practice, trial-and-error tool setting methods are entirely eliminated and a substantial reduction in scrap losses achieved. Set-up time for fixture and tool changes is six hours.

The accompanying operation sheet shows the work performed by the individual spindles on the five transmission housing parts. In some instances, identical tools are used to bore mating holes in separate parts that are later assembled face to face. With this type of tooling and the universal fixture-locating method, it is possible to align the bored holes of the different parts with ease and precision. Cutting feeds and speeds have been selected to produce smooth bores. Pick-off gears provide for speed and feed alterations in the event of design changes in the work handled.

Another important design feature of the machine, which insures a high degree of boring accuracy, is the separation of the gear-boxes from the spindle housings. This arrangement substantially reduces variations in the spindle performance as a result of heat rise normally generated by the gears. It is, therefore, easy to maintain the prescribed tolerances on center distances and other dimensions.

Heat rise effects on the spindles during cutting operations are also alleviated by the provision of individual spindle housings for the spindles that are employed on the heavy boring cuts. The use of stub spindles eliminates the necessity of bushings and guide plates that would reduce flexibility of the machine.

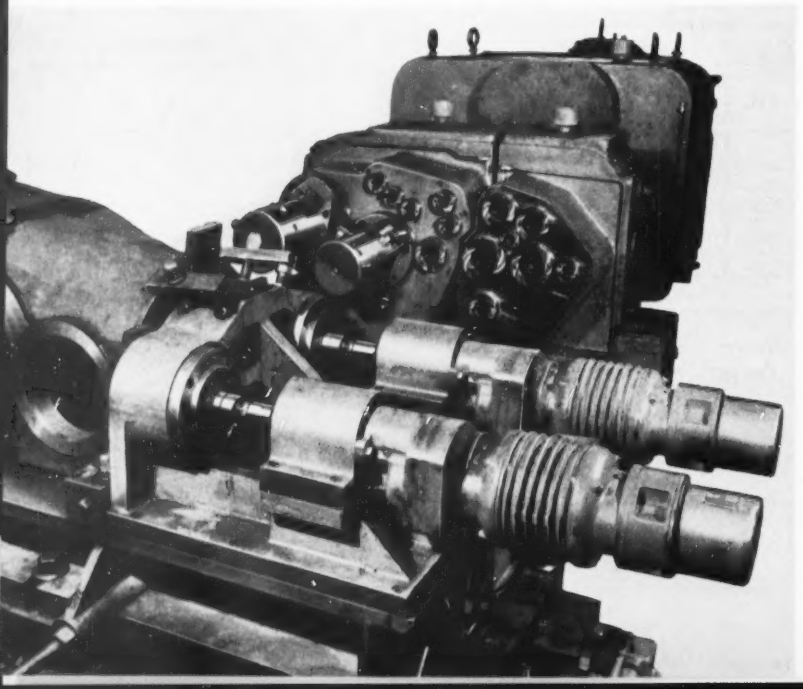
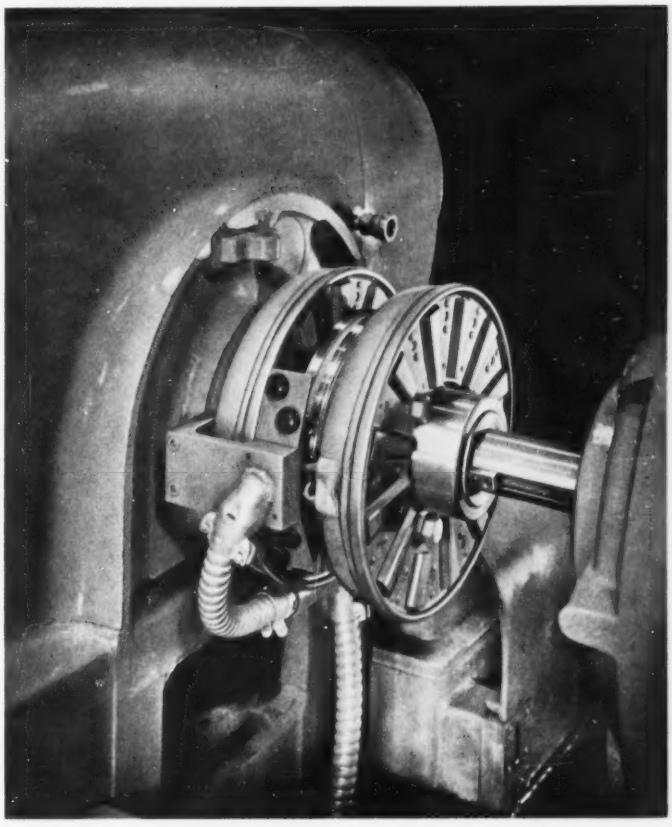


Fig. 3. View of auxiliary spindles that bore holes in final-drive housing at right angles to the holes machined by the spindles on the two tool-heads

Magnetic Controls Speed Machining Cycles



Electromagnetically operated friction brakes, clutches, and combination clutch-couplings, all described in this article, offer machine tools simplified design and give their mechanical functions greater flexibility and higher sensitivity than ever before

MAGNETIC brakes and clutches are today a feature of an imposing number of machine tools. For short, repetitive work cycles on semi-automatic and automatic metal-working machinery, the practically instantaneous operation afforded by such control proves ideal. Spindles, tables, slides, screws, and shafts are common machine elements now magnetically started, stopped, and reversed. This article reviews the design and application to machine tools of motion control units produced by the Warner Electric Brake & Clutch Co., Beloit, Wis.

Three basic units are produced by this company: a magnetic brake, a magnetic clutch, and a combination magnetic clutch-brake. Each is simple in principle and construction, being essentially a dry friction disc type mechanism actuated by the attraction of an armature to a magnet. One of the brakes is illustrated in Fig. 1. This unit is used where machinery cycles require frequent starting and stopping of the driving member, such as is represented by the motor shaft.

The magnet is fastened to the motor frame or to a rigid part of the machine, and the armature is attached to a hub. A tapered bushing locks the hub to the motor shaft. Drive pins that fasten the armature to the hub permit a slight floating movement along the motor shaft axis.

In operation, when the stop-button of the motor is depressed, the doughnut-shaped iron magnet is simultaneously energized and attracts the armature to complete the circuit, thus arresting the movement of the shaft. Depressing the motor start-button de-energizes the magnet, and in rotating with the shaft the armature moves out of contact with the magnet.

Standard brake units operate on 90 volts of direct current at 0.35 ampere, or on 6 volts at 3.5 amperes. Brake performance is under the control of the flux created by the magnet. That is, the amount of flux and its rate of build-up govern the torque that is transmitted, as well as the speed of operation. The magnet is so designed that the voltage of the unit brings the flux to a value at which the iron in the poles of the magnet is saturated. The armature is then

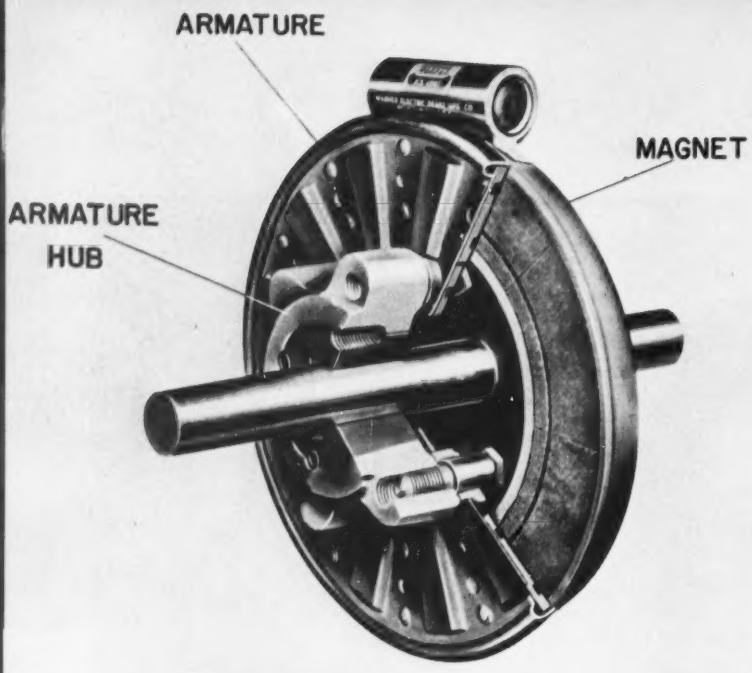


Fig. 1. In the brake unit, the armature rotates with the shaft, and the magnet is stationary, being fastened to the motor frame or other rigid surface.

held against the magnet with sufficient force to transmit the rated torque.

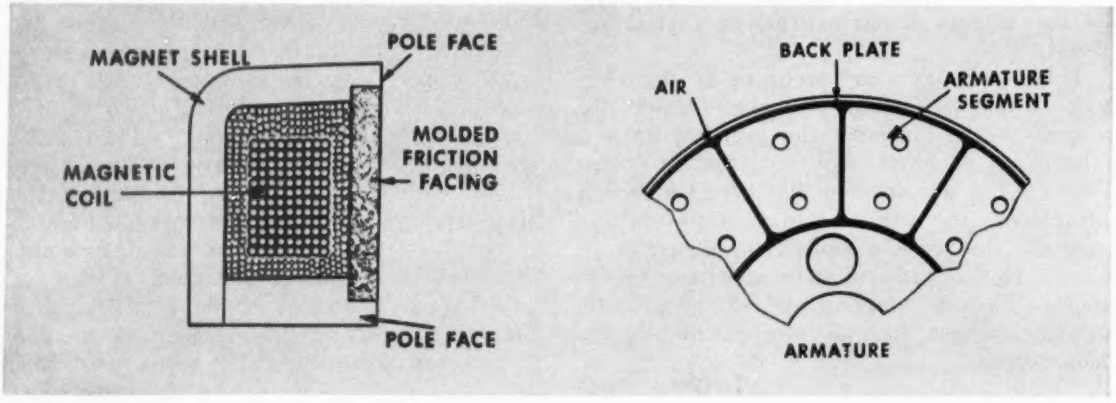
A rheostat readily controls torque output, varying the resistance in series with the magnet. Performance ranging from relatively slow, cushioned stops to rapid stops measured in milliseconds is obtained by lowering or raising the rheostat setting to suit desired changes in torque load or cycle speed.

In the cross-sectional drawing of the magnet, Fig. 2, can be seen its shell, coil, and molded friction facing. Current reaches the coil through terminals (shown on top of the magnet in Fig. 1). The construction of the armature is illustrated in Fig. 3. The metal segments of the armature are riveted and brazed to a steel back plate along their center lines. Flutes in the back plate behind the segments provide an outlet for rapid heat dissipation. Heat created in one segment does not spread to the adjacent segment. This design permits full contact to be maintained with the magnet, despite expansion of the armature when hot. The larger hole seen in the drawing has an Oilite bushing pressed into it to accommodate one of the drive pins along which the armature can float axially.

Magnetic clutches are used for rapid and frequent linkage of a driven member to a continuously running driving member. They differ from the brakes in that the clutch armature rotates with the driving member, and the magnet with the driven member, rather than being

Fig. 2. The magnet consists of a coil imbedded in a shell of magnetic material.

Fig. 3. Flutes behind the segments help to keep armature cool during operation.



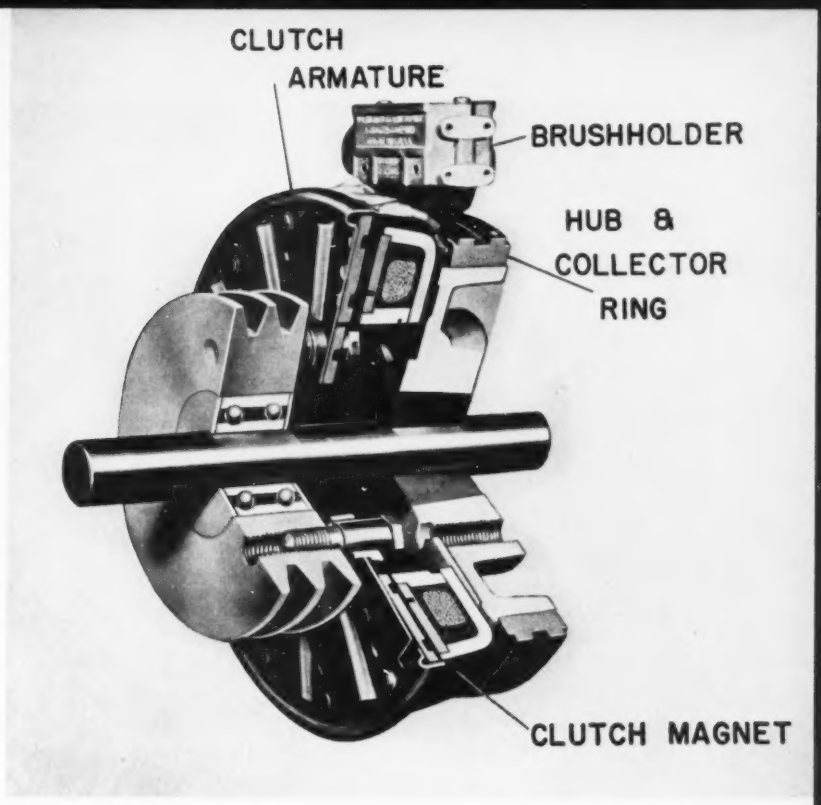


Fig. 4. The magnet of the clutch receives current through a collector ring and brushes. Rotation of the ball bearing mounted sheave is independent of shaft.

stationary as is the brake magnet. To energize the clutch magnet, a collector ring and a brushholder assembly are therefore required.

A magnet clutch is shown in Fig. 4. This particular unit transmits the drive of a motor connected by V-belts with a sheave to a through shaft. A ball bearing permits the sheave to rotate freely and independently of the shaft. Both the armature, fastened by drive pins to the sheave, and the magnet are identical in design to their counterparts in the brake unit.

The magnet is mounted on a hub which is locked to the through shaft by a tapered bushing. Pinned to the periphery of the hub is a collector ring. Current reaches the magnet through brushes that bear on the bands of the rotating collector ring, with leads running from the ring to the coil of the magnet.

Certain machine tools have a magnetic clutch of the coupling type, shown in Fig. 5. It is a variation of the basic clutch design, and is used where the driving member consists of a shaft in alignment with the driven shaft. Here, the armature is joined to the driving shaft by a two-piece hub. The outer member of the hub, to which the armature is secured, is splined internally, and meshes with a crown gear around the periphery of the inner member. This construction provides an automatic take-up for wear of the friction surface of the magnet. It also en-

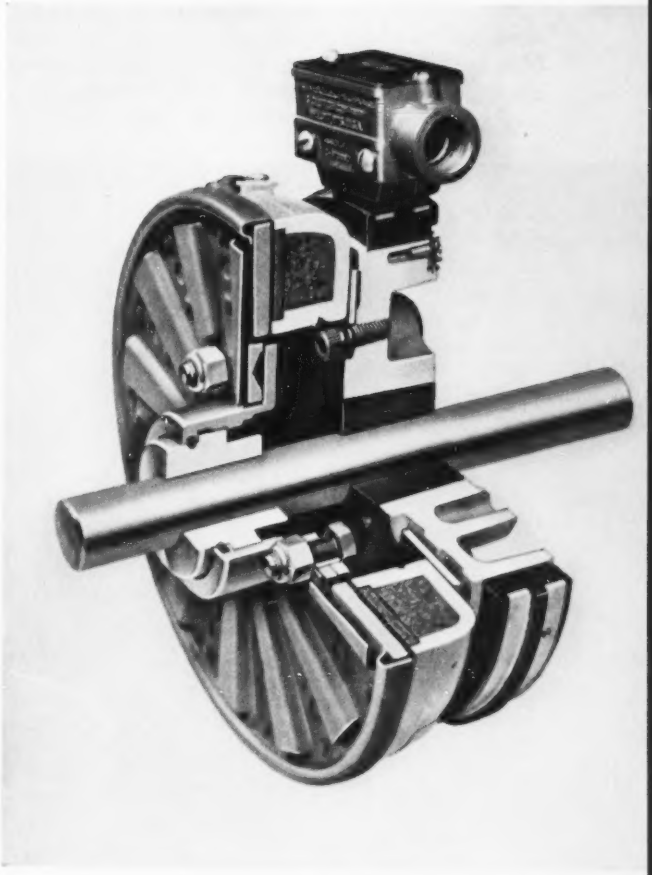


Fig. 5. The clutch-coupling transmits power from a driving shaft to a driven shaft.

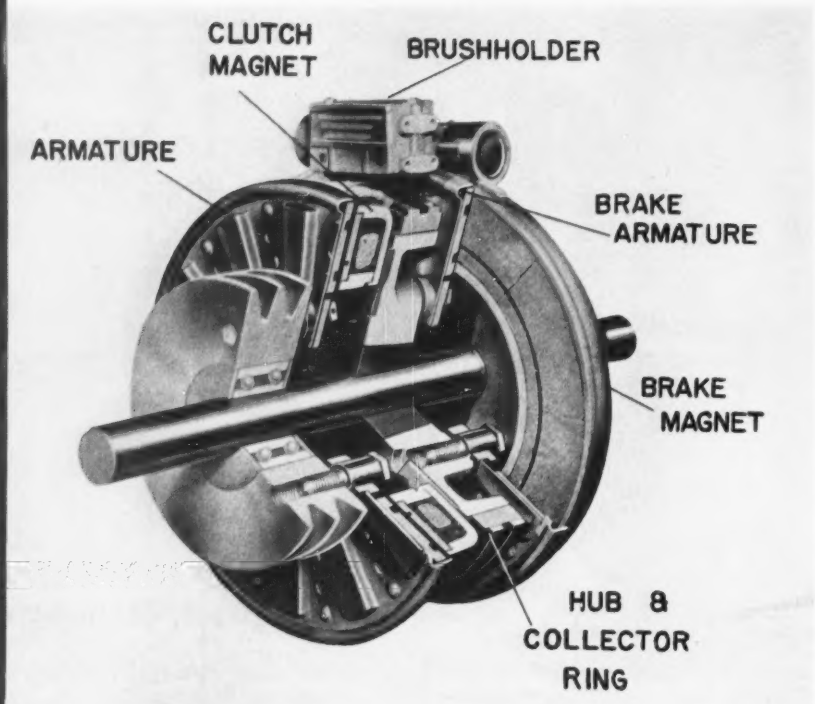


Fig. 6. In the clutch-brake unit, the clutch magnet and the brake armature are fastened to a common hub. A feature of the design is its compactness.

Fig. 7. Quick, accurate adjustment of the stroke of the shaper ram is facilitated by the clutch-brake unit.

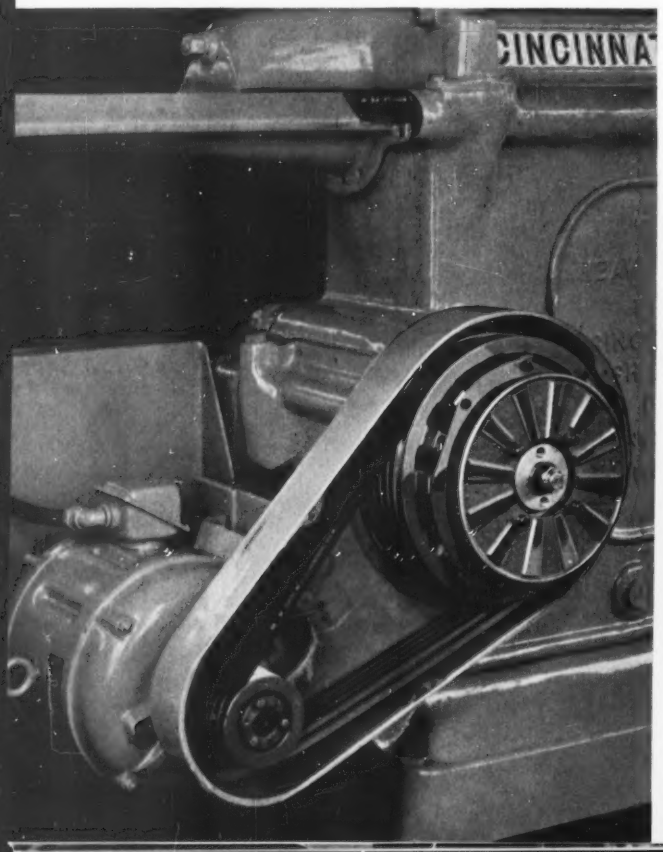
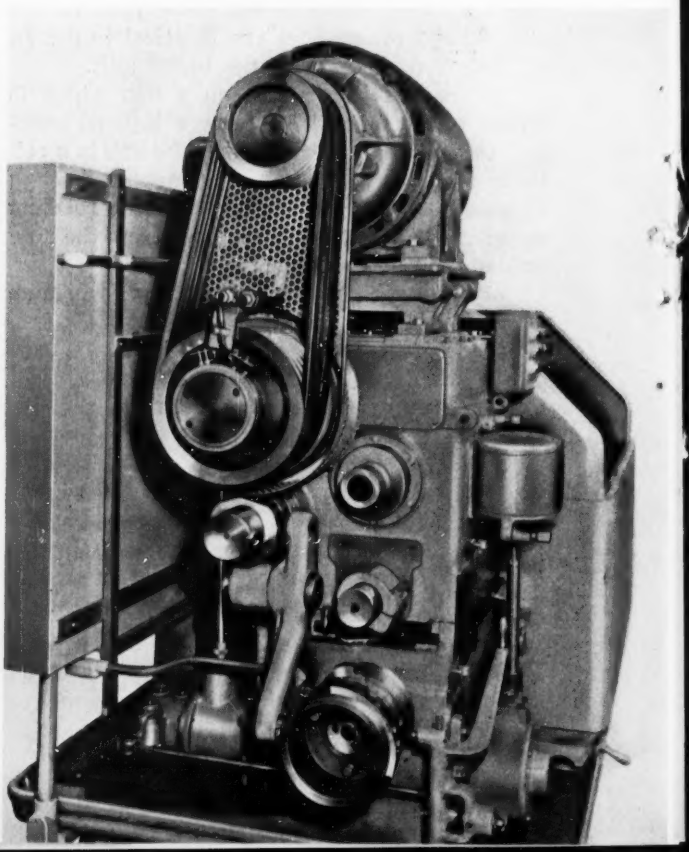


Fig. 8. The drive on this automatic lathe is transmitted from the motor to a clutch-brake on the spindle.



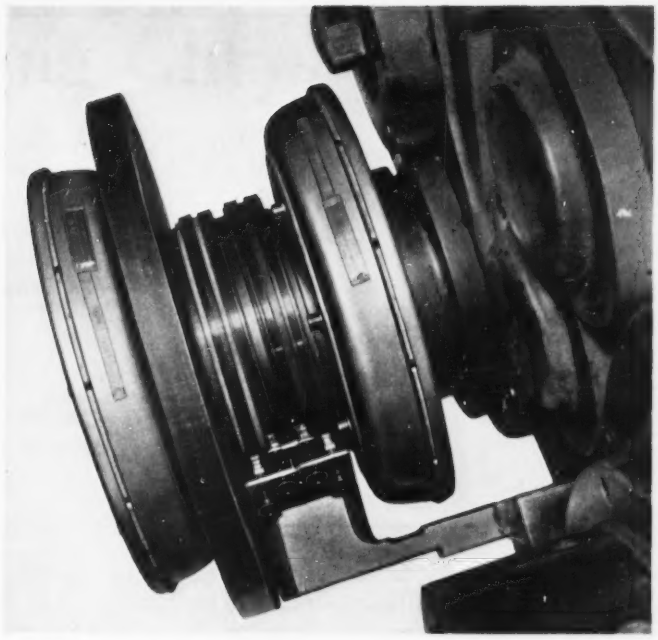


Fig. 9. When the turret lathe runs forward, it is speedily stopped by energizing the reverse clutch; when rotating in reverse, the forward clutch is energized.

ables the hub to better absorb the shock of rapid starts and stops.

The third unit made by Warner is the clutch-brake illustrated in Fig. 6. It finds wide application on machine tools requiring a compact arrangement of a clutch and a brake. The clutch section of the unit is similar to that in Fig. 4, the drive being directed from a continuously rotating motor sheave to a through-driven shaft. Likewise, the brake section is similar to the one in Fig. 1. In this instance, the clutch magnet and the brake armature are fastened to a common hub. The circuit is arranged so that by depressing a single stop-button, the clutch magnet is de-energized and the brake magnet energized a split second later through a relay.

Typical examples of the many machine tools incorporating magnetic motion control will now be considered. The Cincinnati 28-inch shaper, Fig. 7, carries a clutch-brake as standard equipment to transmit the motor drive to the gear train leading to the bull wheel. A short operating lever affords finger-tip control and the ram can be quickly and accurately stopped at any point in its stroke. Jogging in 0.001-inch distances is accomplished by reducing the current to the clutch magnet.

The Monarch Model 20 Mona-Matic lathe em-

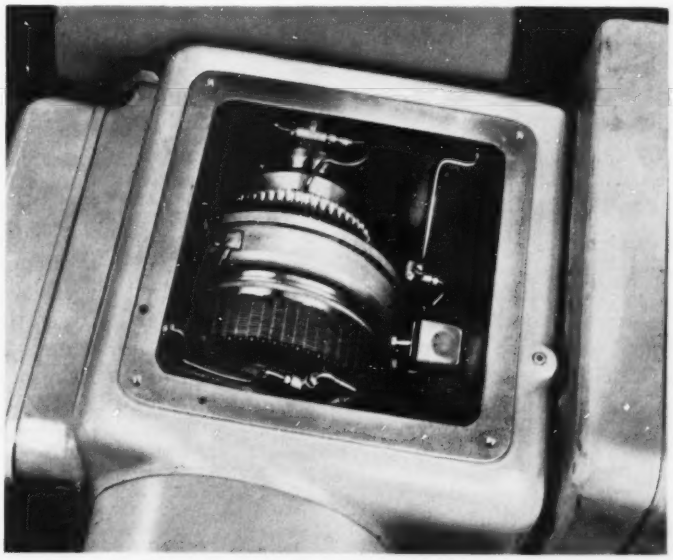


Fig. 10. Positive feed under heavy load is transmitted through a magnetic clutch in this hobbing machine drive mechanism.

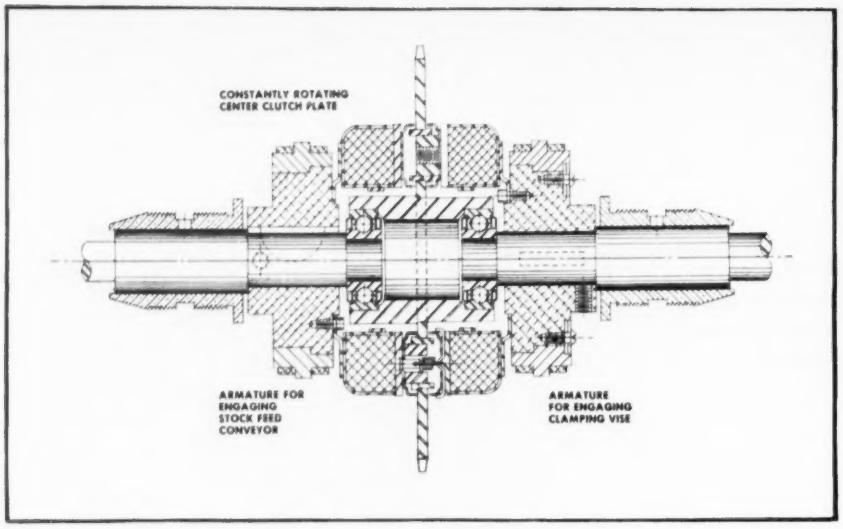


Fig. 11. The center clutch plate of the power hacksaw is engaged alternately with the conveyor magnet and the vise magnet.

ploys a clutch-brake in its headstock, as can be seen in the heading illustration. Since the motor and spindle are in line, the clutch section is of the coupling type referred to in Fig. 5. The unit enables the spindle to be brought from its top speed of 2700 R.P.M. to a dead stop in slightly more than a second. All backlash in the gearing is absorbed without shock.

In Fig. 8 is shown an application of a clutch-brake to a Jones & Lamson 12-inch Fay automatic lathe. This is a view of the headstock end of the machine. The unit is mounted directly on the main driveshaft, being automatically operated by a dog on the control cam-drum.

The Gisholt Machine Co. combines two magnetic clutches to control forward and reverse rotation of its saddle type turret lathe. In Fig. 9 is seen the arrangement of both clutches and their collector rings. Adjacent to the forward, or outer, clutch is a free-turning hub to which is attached a sheave (not shown) connected to the drive motor by V-belts. Both clutch magnets are fastened to the hub. The forward clutch armature is keyed to the shaft supporting the hub, while the reverse clutch armature is keyed to a sleeve that is driven in the opposite direction. To stop the machine spindle, the inoperative clutch is energized through a switch to apply a retarding torque.

In Fig. 10 is a view of the magnetic feed clutch featured as standard equipment on a Barber-Colman 16-16 universal hobbing machine. The clutch controls a worm-wheel engaged to a screw located between the bedways. This screw moves the work in synchronization with the speed of the hob. The same machine also has a magnetic brake in its rapid-traverse system to eliminate coasting of the carriage.

In Peerless Mechani-Cut hacksawing machines, a magnetic clutch serves the dual purpose of advancing the stock and then clamping it in a vise. Following the cut, the vise is opened and the stock again advanced. Operation of the hacksaw is completely automatic, from the moment a length is loaded until it has been entirely consumed. The drawing, Fig. 11, shows the clutch design used. A free-running center plate driven by a chain from the machine motor has an armature on each face. The plate can float laterally and is attracted when either the magnet on the stock feed conveyor or the magnet on the clamping vise is energized.

* * *

"Electrocution" Helps Preserve Mothball Fleet

The bottoms of the United States mothball fleet, harbored at Wilmington, N. C., are being "electrocuted" to keep them from rusting. In order to reduce the corrosion of more than 2100 reserve vessels, General Electric Co. engineers, in cooperation with the Maritime Administration, United States Department of Commerce, have helped to devise a cathodic protection.

Electrodes are submerged in the mud along the river or harbor, and connected to on-shore rectifiers that set up direct-current voltage between the submerged portion of the ship and the water. The circuit created prevents corrosion. As protection from the salt-water atmosphere, the rectifier stacks are hermetically sealed in oil-filled metal containers. According to the Maritime Administration, cathodic protection costs but one-fifth of other maintenance means, thus saving the Government approximately $1500 for each ship annually.

Producing Chrysler's PowerFlite Transmission

Second and concluding installment of an article describing some of the more interesting operations and the machines used in manufacturing the latest automatic transmission at the new Indianapolis Plant of the Chrysler Corporation

By CHARLES H. WICK
Associate Editor

SOME of the processes and equipment used in manufacturing Chrysler's PowerFlite automatic transmission were described in the first installment of this article, published in March, 1954, MACHINERY, page 157. Additional interesting operations performed on castings, gears, and aluminum parts for the transmission will be described in this concluding article.

Cast-iron housings for the front oil-pumps of the automatic transmissions are turned, faced, grooved, and chamfered on Heald vertical, cam-operated, three-spindle machines, such as the one seen in Fig. 13. The castings are loaded flange face up on vertical mandrels, locating from previously turned surfaces and a drilled hole in the flange. Each housing is completely machined in one setting, and one casting can be loaded while two more are being machined.

The periphery of the housing flange, 7.0015 inches in diameter, is finish-turned within plus or minus 0.0005 inch by a carbide-tipped tool mounted in a block adjacent to each work-holding spindle. Three more carbide-tipped tools, mounted in another block at each spindle, cut a groove 0.125 inch wide by 6.615 inches in diameter in each rim and chamfer both sides of the flange. The joint surface of the pump housing is finish-faced by a fifth carbide-tipped tool at each spindle.

Cast-iron front oil-pump gears for the automatic transmission are heat-treated and drawn to a Brinell hardness between 207 and 229 prior to machining. Internal involute splines in these gears are cut to finished size on a Colonial 15-ton, 66-inch stroke, pull-up broaching machine, Fig. 14. Two castings are broached at a time, the gear blanks being located and clamped in a shuttle type work-holding fixture. The internal diameter, or bore, formed by the thirty-three splines in each gear is held within plus or minus 0.0005 inch of the required 3.1445-inch size. A hydraulically actuated device is provided to automatically handle the high-speed steel, combination round and spline broach.

The teeth on most of the gears for the PowerFlite transmission are cut on a battery of Fellows rotary gear shapers, such as the one seen in Fig. 15. Each of these huge machines

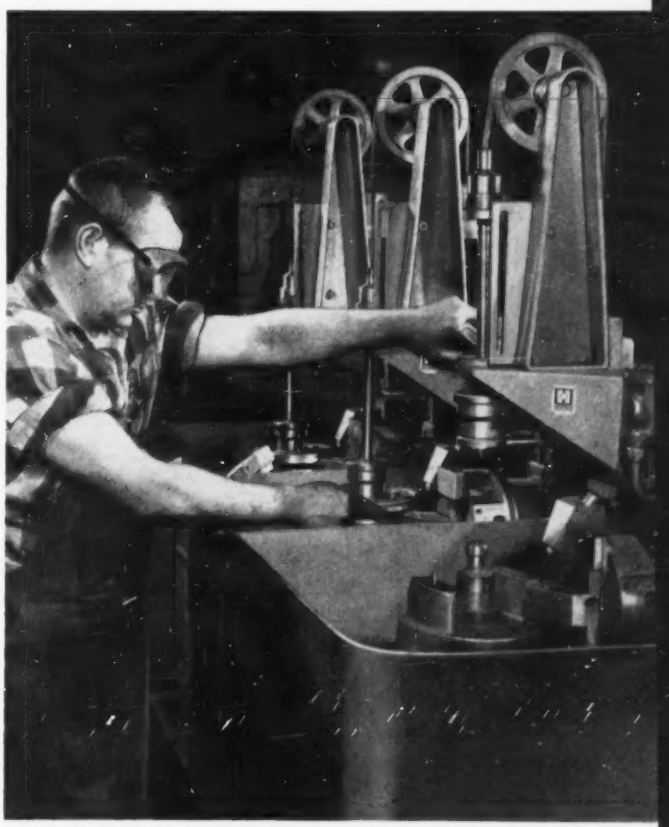


Fig. 13. Cam-operated, three-spindle machine for turning, facing, grooving, and chamfering cast-iron housings for transmission oil pumps.

Fig. 14. A 15-ton, pull-up broaching machine is used to cut thirty-three internal involute splines in oil-pump gear. Two gears are broached at a time.

has ten complete gear-cutting units mounted on a rotating turret with a single base. The speed of turret rotation can be varied by means of change-gears to provide cutting cycles from two to twenty minutes. The cutting unit at each of the ten work stations has an individual motor drive and controls, cutter feed gears, and pick-off gears for changing the number of strokes per minute of the cutter. When the cutting cycle has been completed on one of the work-pieces, the cutting unit automatically stops.

Cutting of the gear teeth is done on the push stroke of the tool, with relief obtained by means of a cam-operated mechanism which withdraws the work-holding spindle on the return stroke of the tool. The cutter is automatically fed to the required depth gradually as the work and cutter are rotated together. All of these gear-cutting machines at the Chrysler Indianapolis plant operate on an automatic cycle, being controlled from a main panel at the operator's working position. As shown, the operator need only remove completed gears and place blanks on the work-holding spindles as they pass his position. Automatic releasing and clamping of the work are accomplished by means of cams attached to the machine base near the loading station. In the set-up illustrated, twenty-three teeth are cut on the forged steel, kickdown sun gears.

The flange joint face of the kickdown sun gear is finished square with the axis of the gear on a Heald rotary surface grinder, Fig. 16. The gear is held by means of special toothed adapter plates mounted on a Cushman collet type ball chuck, locating from the bore and a 3 5/8-inch diameter face. A maximum surface roughness of 20 micro-inches r.m.s. is maintained, while squareness of the face with relation to the pitch diameter of the teeth and parallelism of the surface are held to 0.001-inch total indicator reading. The diamond used for dressing can be seen directly below the abrasive wheel, which is 14 inches in diameter by 1 inch wide.

Planet pinions for the kickdown mechanism of the automatic transmission are rough-blanked from 1 17/32-inch diameter, annealed steel bar stock on six-spindle Conomatics. Both opposed, parallel faces of the pinion blank are ground simultaneously on a Gardner horizontal, double-spindle disc grinding machine, Fig. 17. Paral-

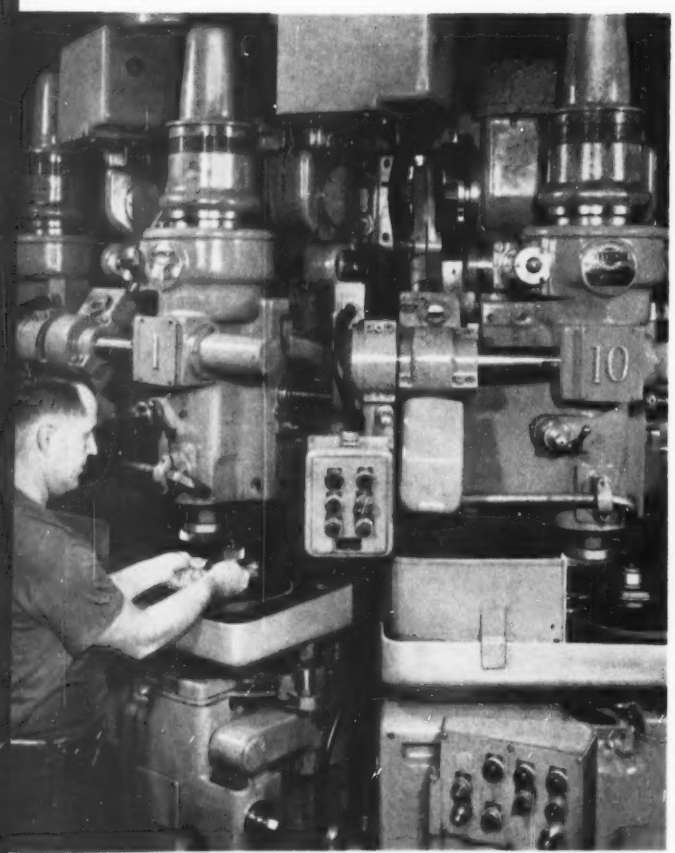


Fig. 15. Ten-station rotary gear shaper for cutting twenty-three teeth on forged steel, kickdown sun gears. Operator removes completed gears and loads blanks on spindles as they pass his position.

Fig. 16. Kickdown sun gear is held by toothed adapter plates on chuck while finishing flange joint face on rotary surface grinder.

lelism and squareness of the faces with respect to the peripheries of the blanks are maintained within 0.0003-inch total indicator reading in this operation.

The pinion blanks are loaded manually into the rotary work-holding fixture, locating radially from their peripheries by means of four hardened steel pins provided in each opening in the fixture. Before passing between the 26-inch diameter opposed abrasive discs, the blanks are located transversely by guide plates. About 0.030 inch of stock is ground from each face in this operation. As the ground blanks are carried from between the abrasive discs, they are automatically ejected onto the chute seen in the illustration by means of a flat spring mounted behind the carrier plate.

Bores of the planet pinions are finished on Bryant internal grinding machines, such as the one shown in Fig. 18, that are equipped with automatic loading and unloading devices. Hole size is maintained within 0.0005 inch (0.7526 to 0.7531 inch in diameter), and maximum surface roughness is held to 20 micro-inches r.m.s.

The pinions are loaded manually in the magazine seen at the top center, and are automatically picked up, one at a time, from the bottom of the magazine by spring fingers on the end of a cam-operated swiveling arm. This loading arm swings the pinion through an angle of about 30 degrees and positions it in the diaphragm chuck of the grinding machine. Then, a cam-actuated draw-bar automatically closes the chuck on the periphery of the pinion, and the loading arm is withdrawn and swung clear to permit grinding. In the illustration, a pinion has just been withdrawn from the bottom of the magazine and is being transferred to the chuck. After grinding, the pinion is automatically ejected and falls onto the gavity chute seen at the bottom center.

This automatic machine is equipped with a high-frequency wheel-head which rotates the 5/8-inch diameter grinding wheel at 35,000 R.P.M., providing a surface speed of 5720 feet per minute. A vitrified-bond, aluminum-oxide abrasive wheel of 80 grain size is employed, and about 0.012 inch of stock is ground from each pinion bore. The work-piece is rotated at 1200 R.P.M.

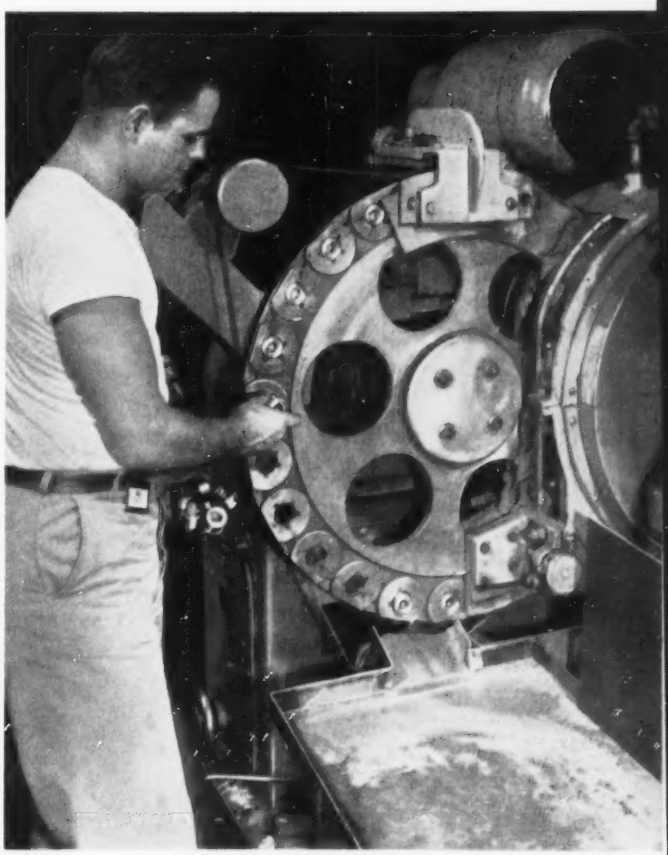


Fig. 17. Both faces of pinion blanks are ground simultaneously, holding parallelism and squareness of the faces within 0.0003 inch, on this horizontal, double-spindle disc grinding machine.

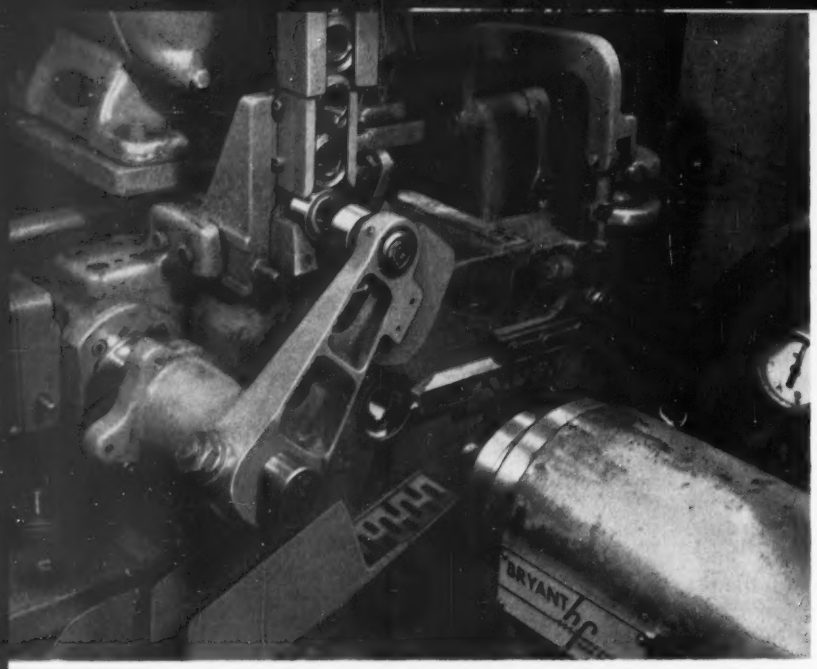


Fig. 18. Automatic loading and unloading of planet pinions are performed in this bore-grinding operation. Bore size is maintained within 0.0005 inch.

After cutting sixteen helical teeth on each planetary pinion with a Fellows ten-station rotary gear shaper, both sides of each tooth are deburred and chamfered by means of the Sheffield two-station De-burizer machine shown in Fig. 19. One flank of the tooth form is cut at the first station, and the opposite flank at the second station. The pinions are placed on arbors, clamped by air-operated pivoted levers, and indexed (after cutting each tooth) by drive gears in mesh with the work-pieces. Movement of the cam-actuated reciprocating tool bits is synchronized with the indexing mechanism, and the machine automatically stops when the pinions have been indexed the required number of times.

Fig. 19. Two-station machine for deburring and chamfering both flanks of the sixteen helical teeth on each planetary pinion for the automatic transmission.

Forged steel reaction shafts for the torque converter of the automatic transmission are machined three at a time on a Bullard Man-Au-Trol, multiple-spindle lathe, Fig. 20. The forgings are gripped by means of Logan three-jaw chucks, and supported between headstock and tailstock centers. Seven carbide-tipped tools are employed at each station to semi-finish-turn two surfaces, finish-turn another surface, face one side of the flange, form an under-cut at the end of the spline surface, and chamfer two surfaces on the multiple-diameter forging. Stock removal from the different surfaces varies from about 0.035 to 0.070 inch.

The light weight of the PowerFlite automatic transmission is due to two factors—fewer parts are required because of its relative simplicity of design, and the number of parts made from aluminum. For example, the long extension housing that encloses the governor and output shaft of the transmission is made from permanent mold aluminum.

Both ends of the 14 5/8-inch long extension housings are precision bored, chamfered, and faced on the Heald double-end Bore-Matic seen in Fig. 21, completing two castings simulta-

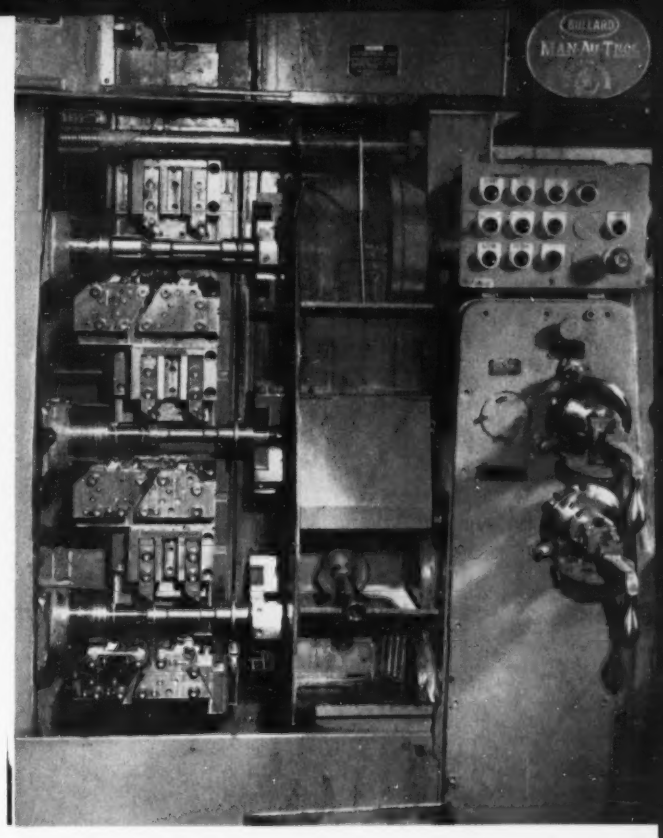


Fig. 20. Various surfaces on multiple-diameter reaction shafts for the torque converters are turned, faced, under-cut, and chamfered on this machine.

neously. The parts are manually clamped in the two-station work-holding fixture, locating by means of two dowels, the finished pilot surface on the large diameter end, and the flange face on the smaller diameter hub end.

The two holders and rotating cross-feed units at the left-hand end of the machine are equipped with carbide tools for boring the housings to a diameter of 4.9375 inches, chamfering these bores, and facing the large joint surface. Similar tooling at the right-hand end of the machine is employed to bore the housings to a diameter of 2.4406 inches, chamfer these bores, and form a 2 5/8-inch diameter snap-ring groove in the bores. A tolerance of plus or minus 0.0004 inch is maintained on both bores, and over-all length of the castings is held to plus or minus 0.002 inch.

Transfer plates for the hydraulic control system of the automatic transmission are die-cast from a high-silicon content aluminum alloy. Smoothness, flatness, and parallelism of the plate surfaces are controlled to a high degree of accuracy because they form metal-to-metal seals that must prevent the leakage of hydraulic fluid under the high pressure and temperature operating conditions of the transmission.

Top and bottom surfaces of cast-aluminum transfer plates are ground on a Besly vertical, double-spindle, wet-grinding machine, Fig. 22. About 0.022 inch of stock is ground from each surface, reducing the thickness of the plates from 0.609 to 0.565 inch thick in this operation and allowing from 0.005 to 0.010 inch to be removed in subsequent lapping.

The transfer plates are manually placed in

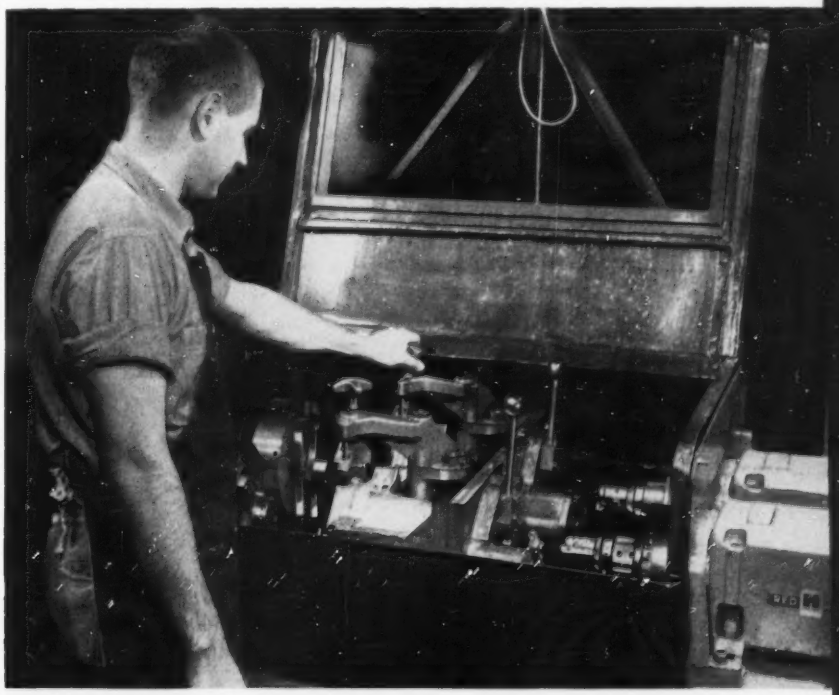


Fig. 21. Double-end precision boring machine completes two cast extension housings at a time. Bore sizes are held to 0.0008 inch tolerance.

Fig. 22. Top and bottom surfaces of cast-aluminum transfer plates for automatic transmission are ground simultaneously on this double-spindle machine.

the nests of a rotary fixture, and are continuously fed between the upper and lower abrasive wheels. Resinoid-bond, aluminum-oxide abrasive wheels of 80 grain size are employed. The grinding wheels rotate in opposite directions at 1750 R.P.M., and are manually fed toward each other as required to compensate for wear of the abrasive. The rate of abrasive wear is approximately 0.001 inch per 100 pieces ground. Dressing is performed after grinding from 500 to 700 parts. Ground transfer plates, completed at the rate of 350 per hour, fall through an opening below the rotary fixture into a tote pan.

This double-spindle grinding machine is equipped with a Delpark self-cleaning filter, Fig. 23, that permits continuous recirculation of coolant. The coolant flows by gravity through a 48-inch wide strip of filter material that is supported by an endless mesh conveyor, and solids are retained on top of the filter material. As the flow of coolant through the filter is reduced by the accumulation of solids, the rising liquid level lifts a float. The float actuates a switch, thus setting the conveyor in motion to discharge the relatively dry solids into a container and unwind clean filter material from a supply roll. A roll containing 100 yards of the filter material lasts about two months. The filter tank holds about 250 gallons of coolant.

Top and bottom surfaces of the cast-aluminum transfer plates are then lapped on the Crane 72-inch Lapmaster machine shown in Fig. 24. A surface finish of 12 micro-inches r.m.s. is produced in this operation, and flatness of the surfaces is maintained within 0.001 inch total indicator reading. Ten plates are placed in the work separator within each of the four conditioning or wear rings, and a plate is placed on top of the work-pieces so that the parts will exert sufficient pressure on the lapping plate.

The work-pieces rest on a special alloy, cast-

Fig. 23. Self-cleaning filter used with grinding machine shown in Fig. 22 permits continuous recirculation of coolant. Solids are discharged into container.

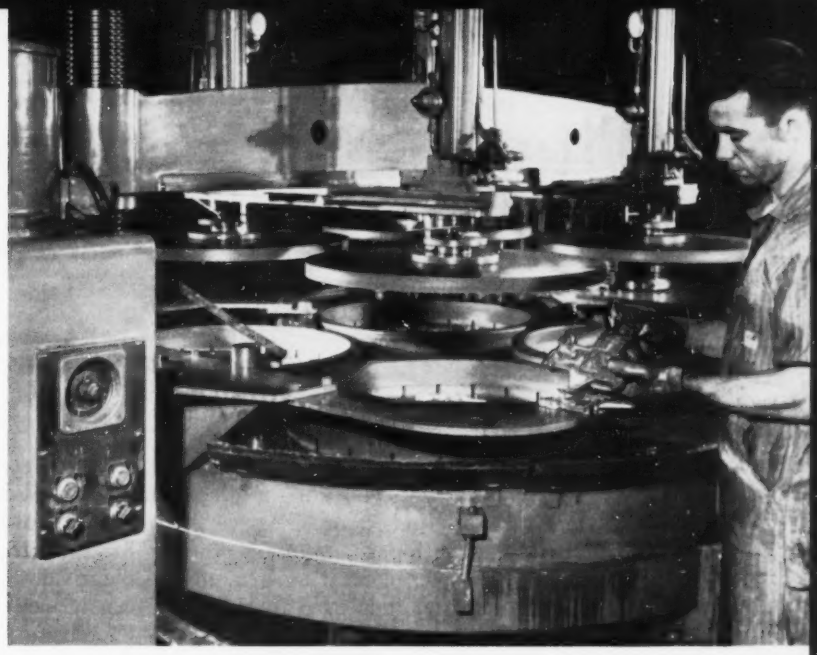


Fig. 24. Flatness of top and bottom surfaces of cast-aluminum transfer plates is held to 0.001 inch, and a surface finish of 12 micro-inches is produced in a lapping operation.

iron lapping plate. This power-driven lapping plate rotates by friction the work-pieces, separators, and conditioning rings. A constant flow of fresh, sharp abrasive, suspended in an oil vehicle, is directed on the lapping plate during the cycle. Thus, stock is removed by rubbing the work-pieces, with irregular motions, over the loose grains of abrasive on the flat lapping plate. About 0.001 inch of stock is removed per minute during lapping. When one side of the transfer plates is finished, they are turned over and the opposite side is lapped. The total time required to lap both sides of forty plates is approximately nine minutes.

Transfer plates and other aluminum parts for the hydraulic control mechanism of the automatic transmission are deburred on the Maizo blasting machine, Fig. 25, built by the Modern Industrial Engineering Co. In this simple operation, the soft parts are cleaned and burrs are removed quickly and safely without scratching or pitting the work-pieces, or changing their dimensions.

The blasting operation is a continuous rotary process, with the work-pieces passing between two reciprocating guns. The rotary fixture makes one revolution in five minutes, and carries twenty-four parts on holding wires bent to fit the parts. Originally, ground corncobs were used for the soft grit blasting. However, this was found unsatisfactory, and now ground walnut shells are employed. The walnut shells are ground in a mill and classified on a vibrating screen to be finer than No. 20 and coarser than No. 60 (U. S. Standard sieve sizes). The dry soft grit is blasted against the work-pieces under shop air-line pressure (90 pounds per square inch) with the blasting guns reciprocating at approximately 4 inches from the parts that are being deburred.

Fig. 25. Aluminum parts for the hydraulic control mechanism of the automatic transmission are deburred by blasting with ground walnut shells. The soft grit prevents pitting of the work-pieces.

Titanium Weldment Replaces Steel Mortar Baseplate

By C. HARTBOWER, Chief of Welding Section
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WITH its brand-new welded baseplate of titanium, the Army's 81-millimeter mortar now gains in effectiveness. This mortar is a smooth-bore, muzzle-loading, high angle-of-fire weapon, consisting of a mortar tube and a baseplate. It is used for lobbing high-explosive shells over obstructions, or otherwise supplementing immobile artillery.

Carried by hand, the mortar can be set up at vantage points that are virtually inaccessible to heavier weapons of equivalent firepower. Obviously, lightness is essential. Until now, the baseplates were made of steel. They weighed 48 pounds, and had to be carried by two men. The new titanium baseplate weighs 24 pounds—exactly half—and is carried by one man.

For a number of years, scientists and engineers have searched for a structural material that would be light in weight and yet have strength comparable to that of steel. Titanium meets this need. Moreover, the ores from which titanium is extracted are abundant in the United States. Titanium is, in fact, the fourth most plentiful structural element in the earth's crust, exceeded only by iron, aluminum, and magnesium.

Titanium is 60 per cent heavier than aluminum, and has 56 per cent the weight of alloy steel. As for strength, commercially pure titanium is comparable to structural steel, or even to low-alloy, high-tensile steel. Experimental titanium alloys have been developed with tensile strengths as high as 200,000 pounds per square inch. On a strength-weight basis, such an alloy is more than 50 per cent stronger than any other formable construction material now available.

Table 1. Comparative Properties of Titanium, Aluminum, and Stainless Steel

Property	Titanium	Aluminum	Stainless Steel
Density, Pounds per Cubic Inch..	0.16	0.10	0.28
Modulus of Elasticity	16×10^6	10×10^6	28×10^6
Strength-Weight Ratio*	400×10^3	200×10^3	150×10^3

* Based on typical 0.2 per cent offset yield strengths for commercially pure titanium, welded 61S-T6 aluminum, and Type 321 stainless steel

In Table 1, a comparison is given of some properties of commercially pure titanium, aluminum, and steel. Although the strength-weight ratio of titanium is excellent, it does have the one disadvantage of a lower modulus of elasticity than that of steel. However, with a modulus of elasticity of 16×10^6 pounds per square inch, titanium surpasses that of aluminum (10×10^6), as well as that of magnesium (6.5×10^6).

One of the most spectacular developments of

Fig. 1. This is the 81-millimeter mortar with the steel baseplate that has been used up to now.

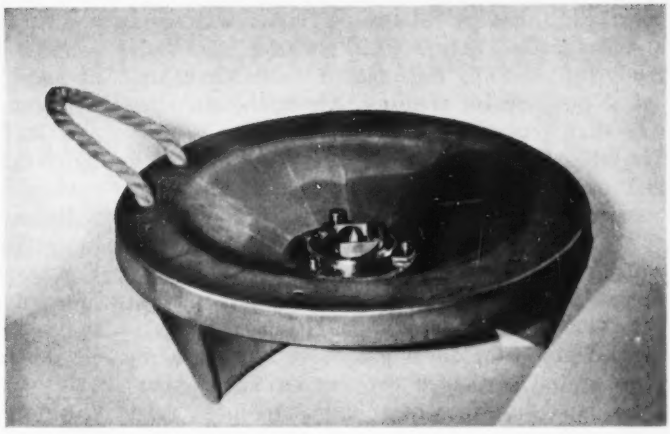


Fig. 2. The new titanium baseplate, which is half the weight of its predecessor, permits the mortar to be carried by one man.

recent years and of considerable importance to the fabrication of titanium has been the introduction of tungsten inert-gas shielded arc welding. It has already largely replaced other methods of welding non-ferrous metals and is making substantial headway in welding steel, particularly stainless steel. The outstanding advantage of this method of welding is that there is virtually no contamination of the weld with undesirable gases. Moreover, with direct-current straight polarity, there is almost complete freedom from spatter, and the weld surface is so regular and clean that little machining is required to produce a finished surface.

In joining titanium, absorption of gases occurs so readily that complete shielding of the arc with argon or helium is essential to obtain a ductile weld. The reactivity of the metal at elevated temperature is so great that an inert gaseous atmosphere containing as little as 1 per cent (by volume) of oxygen or nitrogen, or having a relative humidity of but 5 per cent, embrittles the weld deposit. This is because water vapor breaks down in the electric arc into atoms of hydrogen and oxygen that may be absorbed by the molten weld metal.

The fact that tensile strength is actually increased by gases in solution in titanium is misleading. For example, a tensile specimen containing a weld joint located transversely to the direction of loading will usually "neck down" and fracture outside of the weld zone, indicating better than 100 per cent joint efficiency. However, a tensile test of a longitudinal weld will reveal an appreciable drop in elongation; and a bend test will disclose a severely embrittled condition as the result of imperfect gas shielding.

The mortar baseplate is made of 0.1-inch commercially pure titanium sheet. Tensile properties of this material before and after joining are given in Table 2.

The first baseplates were fabricated at the College Park Station of the United States Bureau of Mines. To minimize contamination from the atmosphere, the welding was done within a chamber approximately 3 feet in diameter and

Table 2. Tensile Test Results of Commercially Pure Titanium

Manufacturer's Designation	Proportional Limit, Pounds per Square Inch (0.01 Per Cent Offset)	Yield Strength, Pounds per Square Inch (0.2 Per Cent Offset)	Ultimate Strength, Pounds per Square Inch	Elongation, Per Cent in 2 Inches
Prime Plate				
RS-55	83,500	98,200	104,200	23
RC-55	59,200	70,000	86,000	24
Ti-75A	55,500	65,800	87,200	24
Butt-Welded, Transverse				
Ti-75A	51,700	65,300	90,300	16*
Butt-Welded, Longitudinal				
Ti-75A	66,500	80,700	103,700	15

*Fracture occurred outside of weld zone.

3 feet high, having collapsible rubber walls and a transparent cover. The sheared materials ready for assembly were placed inside the chamber in position for welding. Air in the chamber was then pumped out and replaced by helium. The chamber was evacuated and refilled with helium several times to assure removal of the last traces of air.

A number of rubber gloves cemented into the walls of the chamber permitted the hands of the welder to reach any point within the chamber. Thus, the complete welding operation was carried out in an inert gaseous atmosphere. In tests at the Ordnance Proving Grounds, Aberdeen, Md., hundreds of rounds have been fired with the baseplate resting on either soil or macadam without failure.

Obviously, if a titanium mortar baseplate is to be standardized and manufactured in quantity for use in combat, it would be highly desirable from a production standpoint to weld it without the use of a chamber. A compromise was attempted by the Bureau of Mines. A titanium mortar baseplate was fabricated in open air, but with every precaution taken to shield the hot metal with inert gas, and with techniques aimed at cooling the metal as rapidly as possible to minimize the interval at elevated temperature, when the metal is most vulnerable to contamination. The baseplate so constructed was subjected to severe testing without failure.

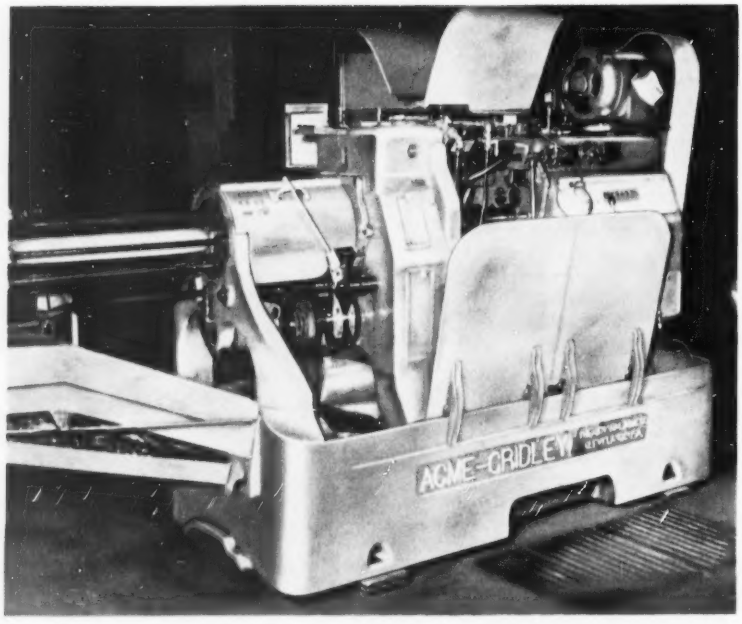
The new baseplate is going to troops for field evaluation. As a burden to be carried over hill and through snow and mud, the soldier will welcome its lightness. The scientist and engineer at home will follow the field tests of titanium, with concern over its lower modulus of elasticity and its possible loss of toughness at the low temperatures that are experienced during winter operations.

Research on titanium and its alloys is moving rapidly; new facts are revealed almost daily. For example, research indicates that a long vacuum annealing at 1100 degrees F. can increase the notch toughness of unalloyed titanium to a considerable extent.

* * *

Aluminum Brazing Methods Featured in Motion Picture

Light-metal brazing techniques are demonstrated and explained in a 16-millimeter sound and color film now being offered to industry by the Aluminum Company of America, Pittsburgh, Pa. This motion picture, entitled "New Horizons in Aluminum Brazing," particularly stresses the advantages that brazing provides in the design and fabrication of aluminum products. Various methods are described separately. The film has a running time of twenty-two minutes. Requests for prints should be made on a business letterhead to the Aluminum Company of America, Motion Picture Section, 854 Alcoa Bldg., Pittsburgh 19, Pa.



Republic Aviation Corporation, Farmingdale, N. Y., has installed a number of its machine tools, such as this Acme-Gridley 9/16-inch automatic screw machine, on "Unisorb" felt pads. The pads, cemented in position, secure the equipment and reduce transmitted noise and vibration. Lag screws or other fastening devices are unnecessary.

How Functional Specifications Affect Gaging Requirements

Tolerances are established to control variations in size, form, position, and function. In this eleventh of a series of articles on dimensions and tolerances for mass production, the author shows how the need for functional specifications arises and how gaging requirements are determined

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IN the majority of cases involving production designs, the dimensional specifications adequately define the conditions which the various components must meet. There are cases, however, where definite dimensional specifications alone will not insure proper functioning of components or their related assemblies. In such cases, additional specifications in the form of functional tests may be required. That functional testing will be needed is often not realized until after initial production is under way and unexpected production or assembly difficulties have arisen.

In addition, some features involve conditions of size, form, and position for which rapid inspection means have not yet been developed. The available types of gages which are used are essentially functional gages that check their conditions of assembly. This is the case with the conventional gages for screw threads and spline shafts.

Some of the conditions that require a functional test may be the cumulative effects of the tolerances or variations of several different components or features of the component where the total resultant variation is the important factor and not the individual variation on any single feature. In some cases, the limiting condition for a given component may be established experimentally by means of some simple test that can be duplicated by the use of a simple functional gage—a gage whose specifications cannot be established directly from the recorded dimensions and tolerances. The simplest and most definite way to record these and other similar conditions is to specify, in words or by an actual gage drawing, the functional test or the functional gage that will be used to inspect them.

This practice is in accord with the general principles heretofore followed for the dimensional specifications. The dimensions, together with their tolerances when given, specify the limiting sizes of the inspection gages. These gages themselves determine the acceptable conditions on the components. Many complex conditions may be difficult or impossible to define precisely with dimensions and tolerances. For them, the direct specification of the design and limiting sizes of the functional gage that will be used for inspection not only follows the general plan for dimensional specifications but also makes for greater precision and definiteness as well as simplicity.

Need for Functional Gages—The number of conditions for which functional gages may be needed is almost infinite in number. In many cases, as noted before, this need may not become apparent until production is under way. Each different condition involves unique problems of its own. Such conditions must be accepted as a challenge to the ingenuity of the designer. Many of the most troublesome production and control problems of today persist because effective control or means of definite measurement for them have not yet been devised. For lack of them, many stopgap measures are used because they are the only ones that are available at the time they are needed. But the search for adequate measures, and the methods for specifying them on the detail drawings, should continue until they are found.

Types of Functional Gages

Dummy Breech Mechanism as a Functional Gage—For example, in the manufacture of field guns, it has been common practice for many years to provide a functional gage known as a "Dummy Breech Mechanism" to test the physical sizes and forms (and their interrelations with each other) of many of the more complex components of the breech mechanism of the gun. The

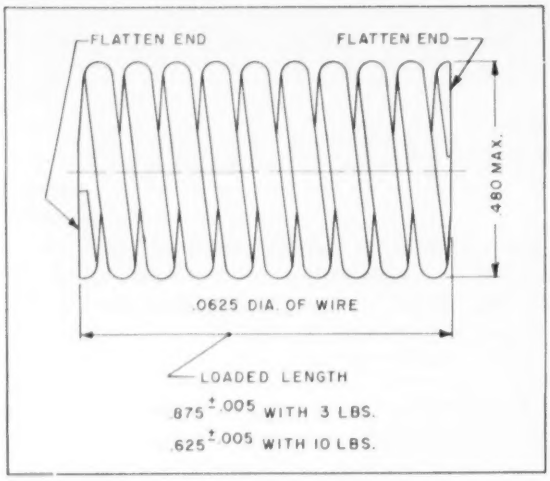


Fig. 1. In theory, if the wire diameter, coil diameter, number of coils, and free length of a compression spring are specified, the description is complete. Actually, however, a functional test is needed if the spring is to meet definite service requirements.

parts of the dummy are made as accurately as possible to the maximum metal conditions of the components and assembled together into an operating mechanism. In many respects, this mechanism is a manufacturing model of the product—at least of the breech mechanism itself.

At the start and during the course of actual manufacture, finished components from current production are assembled into the "Dummy Breech Mechanism" in place of the respective model components, and the mechanism is operated to prove the adequacy of this component taken from production. These components must therefore satisfy both the requirements of the inspection gages, which are defined by the dimensional specifications of the detail drawings, and also the assembly and operational tests when assembled into the dummy.

If difficulty arises in meeting this double test, the dimensional specifications must be revised to meet the situation. This may involve changes in the inspection gages or the introduction of additional ones wherever their use is found necessary. In addition, changes in gages mean changes in the production tools and equipment or improvements in the manufacturing technique, or both.

Manufacturing Models as Functional Gages—Mention has previously been made of the value of manufacturing models, both to prove the Production Design and also to act as a functional gage, when needed, to prove the tooling and the gaging of any specific completed component when the actual production first gets under way. All of the inspection—both of the individual features of the component and also of the completed component—is necessary to maintain the dimensional quality of the product. It must be clearly understood that the concept of perfection does not enter into this inspection or testing. *Quality, in this respect, is that which makes an element or component good for a certain purpose or use, and the term "quality" is meaningless apart from the use in view.* This usefulness or quality must be attained if the product is to meet the demands which will be made upon its service.

Functional Gages for Individual Features—The manufacturing model will prove to be an effective functional gage for completed components, but there may be many individual features or combinations of them that can be controlled more effectively by simpler functional gages. Take, for example, a long bolt or a tie-rod, say, 1 inch in diameter and 10 inches long. Its conditions of size are specified with tolerances, but the question remains as to how nearly straight this component must be. Any attempt to specify this condition by means of dimensions and tolerances alone will prove to be a complex task.

Here the specification of a simple functional gage will meet all needs in a simple and effective manner. It is the conditions of assembly that determine the specific sizes for this functional gage, not the particular dimensions given for the size of the component. If the hole through which this bolt or tie-rod is assembled is 1/16 inch larger in diameter than the design size of the component, then the functional gage is a ring gage, 10 inches long, with a bore 1/32 inch (one-half the clearance) larger than the design size of the component. In such a case, the functional gage and the test are specified on the detail drawing by the note: "Component must assemble of its own weight into straight bore, 1.031 inches in diameter, 10 inches long."

If the mating component has a continuous hole of about the same length, a similar functional gage in the form of a long cylindrical gage, which must assemble of its own weight into the bore, is specified for it, namely a cylindrical plug gage, 1.031 inches in diameter and 10 inches long. If each component meets its own functional test, then the assembly of these components without interference is assured.

Functional Gage for Bore of Rifle Barrel—A similar problem is that of trying to specify the straightness of the bore in the barrel of a rifle. It is common practice in many plants that manufacture small arms to depend upon visual inspection by a skilled operator to control this factor. Often the straightening of the barrel and the inspection for straightness are combined into a single operation.

Reflected light in the polished bore of a rifle barrel makes visible to the eye of the operator who is looking through the bore as it is held to the light a series of rings of increasing diameter. If these reflected rings appear to be concentric, the bore is straight. At any bend, these rings are eccentric. The nature of the eccentricity indicates the direction of the bending. The operator and the inspector must be able to locate the position of these bends from the appearance of the reflected rings, and to straighten the barrel accordingly. A similar final inspection for straightness is usually given to the finished barrel before it is sent to the assembly department.

It takes time and much practice to acquire the necessary degree of skill to perform this visual inspection accurately. Furthermore, all persons do not have the sharp vision and the necessary inherent aptitude to acquire this skill. With a limited number of skilled operators available, and the need of a greatly increased rate of production because of emergency conditions, some other test must be substituted for this visual inspection. In addition, even with skilled operators this task imposes a considerable strain on the eyesight, so that the rate of inspection and its accuracy tend to be reduced as the day wears on. Overtime is out of the question. Here is another place where the introduction of an effective functional gage will prove to be valuable.

Experiments indicate that the straightness of the last 6 inches near the muzzle of the bore of a rifle barrel is the essential condition for accurate shooting. Hence a functional gage for testing the straightness of the bore consisting of a cylinder—rounded or pointed at the end, 6 inches long, and some very small amount under the maximum metal size of the bore of the barrel—can be used. The size, or amount smaller, for this functional gage must be determined by actual experiment. Several sample barrels, some within the acceptable limits of straightness and others beyond these limits, must be used. A size for this functional gage must be determined such that the gage will slide of its own weight through the bore of acceptable barrels and stop in the bore of the unacceptable ones. After this size is determined by trial, it will be recorded on the detail drawing as the diameter of such a functional gage.

Functional Test of Lead-Screw—Another example of a feature or property of a component that requires a functional test rather than a definite measurement of the accuracy of an element of the surface itself is the accuracy of the performance of the lead-screw of a machine. It is not the accuracy of the surface of the thread on the lead-screw, itself, that is important but the accuracy of the advance of the nut on the screw.

The mating nut has several threads and hence does not follow exactly all of the individual and local errors on the thread of the lead-screw but always makes contact or bears on the highest areas of the screw surface. Hence the test of this requirement is the measurement of the advance of a nut of the same length as that of the mating component when the lead-screw is revolved. This

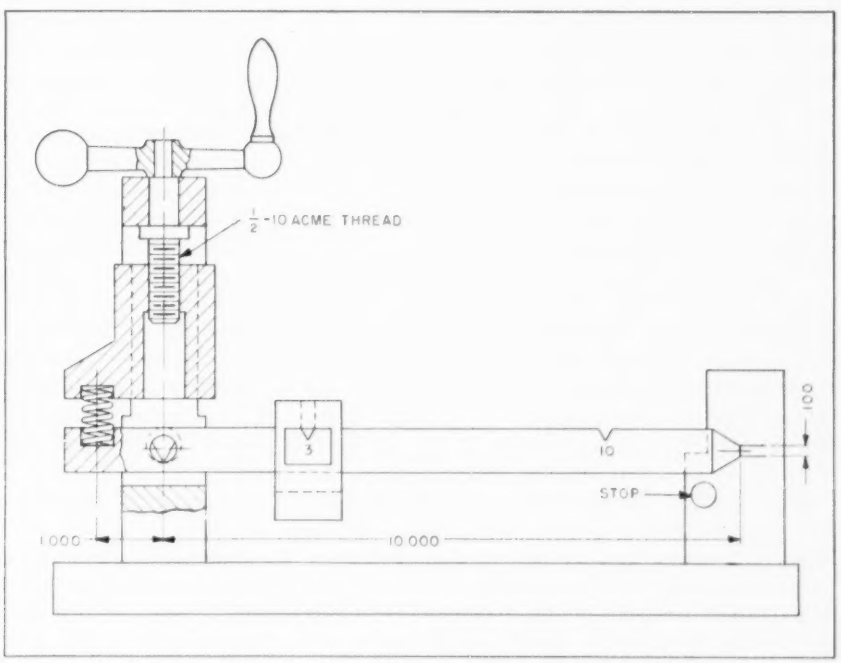


Fig. 2. This type of compression spring tester can be used to check the performance of the spring in Fig. 1 at the two loaded lengths specified.

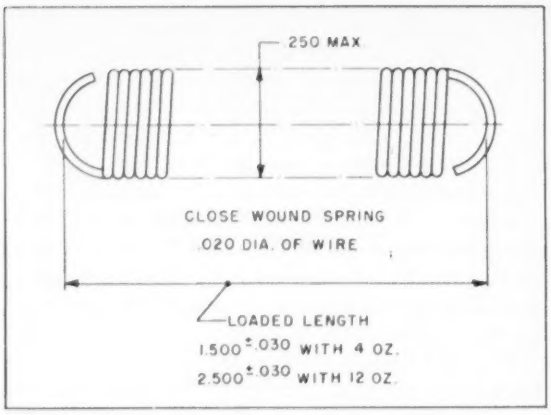


Fig. 3. The dimensional specifications of this close-wound tension spring have been made incomplete deliberately to give the spring manufacturer considerable liberty in deciding how best to meet the important load conditions specified.

is a functional test, and it should be noted on the detail drawing as a part of the dimensional specifications of the lead-screw.

Functional Test of Compression Spring—The specification of the physical characteristics of a helical wire spring is another example where a definite functional test must be applied if the spring has a definite and important service to meet. In theory, if the diameter of the wire, the diameter of the coils, the number of coils, and the free length of a compression spring of a given material are specified, the description is complete. In practice, with these specifications only, the actual performance of different springs made to the same specifications will vary widely.

In the assembly of the product, such a spring usually has two important functional lengths: one is a maximum length under some smaller load; and the other, a minimum length under a greater load. In the construction of the experimental model, several springs may be made and tried out in operation before one is obtained that gives the required action. In other words, the necessary spring action must often be obtained by experiment. Once this is accomplished, the results can be duplicated in production, within close limits, only by specifying the force the spring must exert at two specified lengths. Tolerances may be specified for the lengths of the spring when supporting the two weights or for the weights on the spring when it is compressed to the two specified lengths.

Therefore, in the specifications for an important compression spring of helical form, the diameter of the spring wire is given as a constructional dimension. If the spring is to be assembled in a hole or counterbore, a maximum diameter only is given for the outside diameter of the coils. If the spring is assembled over a pin, a minimum diameter only is given for the inside diameter of the coils. If the spring is not only assembled in a hole but also over a pin, a maximum diameter only is given for the outside diameter of the coils, and a minimum diameter only is given for the inside diameter of the coils. In this last case, the difference between these two diameters will be much greater than double the nominal diameter of the spring wire. Then two loaded lengths of the spring under two specified loads, with tolerances, are given to control its performance in service. Such a practice gives the greatest possible latitude to the spring manufacturer and insures the production of springs that will have a uniform action in service.

A helical compression spring which is to assemble into a recess or counterbore 1/2 inch in diameter is shown in Fig. 1. The functional requirements are that it will exert a pressure of 3 pounds when compressed to a height of 0.875 inch and a pressure of 10 pounds when compressed to a height of 0.625 inch. The maximum outside diameter of the coils is given as 0.480 inch to allow clearance between the outside diameter of the spring and the counterbore. The nominal diameter of the wire is 0.0625 inch. All dimensions are constructional except the loaded heights and the maximum outside diameter of the coils. The ends of the spring are to be flattened as indicated on the detail drawing in the illustration.

The maximum outside diameter of the coiled spring is inspected with a ring gage of 0.480 inch diameter. The spring must pass freely through this gage. One form of a functional gage to test the heights of the spring under the specified weights is shown in Fig. 2. This functional gage consists of a base carrying two posts, one with a slot to receive the pivoted weighing arm and the bracket or support for one end of the spring, and the other with registering lines corresponding to the tolerance of plus and minus 0.005 inch on the loaded heights of the spring.

The weighing arm has a counterbored recess on one side of the pivot to receive the bottom end of the spring, and a beveled edge with a reference line at its end on the other side of the pivot. It also carries a rider such that, with the weighing arm balanced, it applies a pressure of 3 pounds on the spring when the rider is positioned by the notch nearest to the pivot and 10 pounds when the rider is positioned by the notch farther away from the pivot, as indicated in Fig. 2.

The bracket that carries the upper end of the spring is made to slide in the slot of the pivot post. Stops are provided on this post to control the position of this bracket so that in its upper

position, when the weighing arm is level, the loaded length of the spring is the specified maximum loaded design length. When the bracket is against the lower stop, with the weighing arm level, the loaded length of the spring will be the specified minimum loaded design length. The bracket is moved up and down by means of the adjusting screw which is turned by rotating the ball-handle, this being fastened to it at the top of the pivot post. A pin is assembled in the right-hand post to act as a stop for the weighing arm and prevent it from dropping too far when the spring is removed.

In operation, the weighing arm is lifted by one hand to permit the spring to be assembled into the functional gage by the other hand. When the spring is in its weighing position, the weighing arm is released. With the bracket adjusted against the upper stop on the pivot post and the rider set to the 3-pound position on the weighing arm, the register line on the weighing arm must be between the two register lines on the post at the right-hand side of the functional gage. When the rider is moved to the 10-pound position on the weighing arm and the bracket adjusted against the lower stop on the pivot post, the register line on the weighing arm must again be between the same two register lines on the right-hand post as before.

Composite Functional Test of Tension Spring—The functional gage and the specifications on the detail drawing for a tension spring, such as is shown in Fig. 3, are very similar to those for a compression spring. This example is a close-wound spring. When it is extended to a length of 1.500 inches between the inner ends of the loops at the end of the spring, it must exert a pull of 4 ounces. When it is extended to a length of 2.500 inches, it must exert a pull of 12 ounces. These loads are the operating ones at the two ends of the stroke or movement of the part to which the spring is attached in the assembled mechanism.

The maximum outside diameter of the coils is specified as 0.250 inch. The nominal or specified diameter of the spring wire is 0.020 inch. This last value is a constructional dimension. No values are given for the number of coils or for the free length of the spring. The load conditions are the most essential ones and the spring manufacturer has full liberty of action in regard to the dimensional conditions.

The spring must assemble freely in a ring gage of 0.250-inch diameter. The functional gage for testing its pull at the specified lengths is shown in Fig. 4. This gage is very similar to the one shown in Fig. 2, except that the weighing arm is above the bracket because the spring must be stretched instead of compressed. Also, grooved pins are provided to engage the loops at either end of the spring instead of counterbores as before.

The weighing arm carries a rider and is provided with two notches, as before, to locate the rider at the two load positions. This weighing arm is mounted in a slot in the left-hand post as

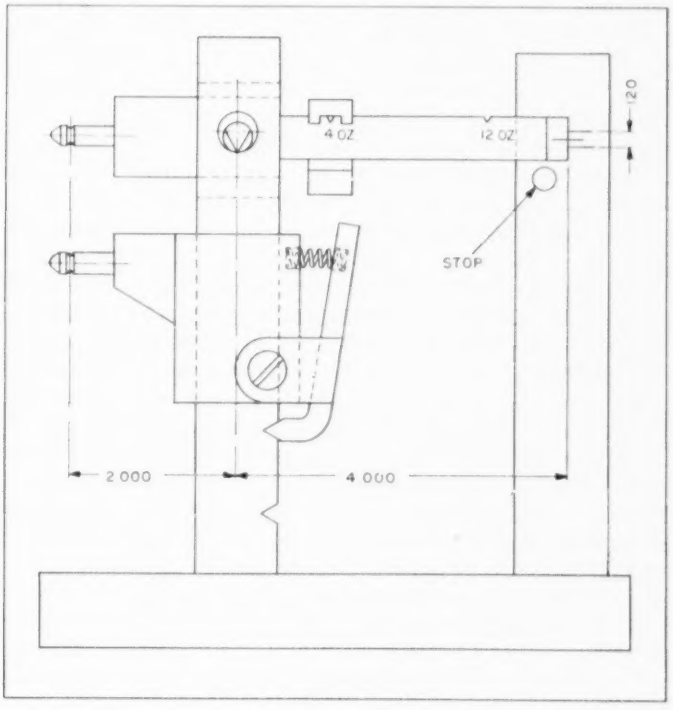


Fig. 4. This functional gage for testing the tension spring shown in Fig. 3 is similar to the compression spring tester, except that the weighing arm is above the bracket because the spring must be stretched instead of compressed.

before. The bracket fits the outside of the square or rectangular pivot post and is retained in position, for the minimum loaded length or maximum loaded length as required, by a spring latch that engages notches in the pivot post. When this bracket is in its upper position and the weighing arm is level, the distance from the top edge of the groove in the pin in the weighing arm to the bottom edge of the groove in the pin in the bracket is 1.500 inches. When the bracket is in its lower position and the weighing arm is level, this distance is 2.500 inches.

The operation of this functional gage is similar to that of the preceding one. The loops at the ends of the spring to be tested are slipped over the ends of the two grooved pins until they engage the grooves. When the rider is in the 4-ounce position and the bracket is in its upper position, the register line at the end of the weighing arm must be between the two register lines on the right-hand post. When the rider is at the 12-ounce position on the weighing arm and the bracket is in its lower position, the register line on the weighing arm must be between the same two register lines on the right-hand post as before.

The load in this example is so small that the bracket can readily be moved by hand. For heavier springs, a cam or screw or other mechanical device must be provided to move the bracket against the pull of the spring. The general design of the functional gage, however, is of this same type for any spring, whether compression or tension.

Problem of Adequately Testing Gears—Another type of machine element that requires some form of functional test to prove its adequacy for service is any kind of a gear. The general problem of the production and inspection of gears is basically the same as for any other type of machine element. For all such elements, every effort must be made to determine as early as possible in production and assembly the essential requirements of the finished components. Then adequate machining processes and manufacturing methods must be chosen or developed to accomplish the task of production and control.

In too many cases, the unique requirements of some of the components in their particular service are not definitely determined until after the actual production has been under way for some time. It is conditions such as these that superimpose the additional burden of many changes or unanticipated refinements in the manufacturing and inspecting operations. Such, in brief, has been the production history of many of the components.

The history of gear design, production, and inspection has been, in many respects, an epitome of that of other machine elements. Even today, all of the essential features and their interrelations have not been fully established. Again, the demands made on the performance of gears are continually growing more severe for greater load-carrying capacity, higher operational speeds, and quieter action. With all this, the existing methods and facilities for measuring the gears are incomplete, inadequate in many respects, or else non-existent.

Functional Requirements of Gears—For gears, as for all other types of machine elements, the dimensional specifications and their translation into definite inspection gages or procedures must be considered under the four major categories: conditions of size, conditions of form, conditions of position, and essential functional conditions. Also, the distinction between the testing of the manufacturing equipment and the gaging of the product itself must be kept in mind. Measurements or tests made to check the equipment can be as elaborate as may be found necessary with little influence on the final cost of the product, because such tests are only required at considerable intervals of time. If simple methods are not available, the more elaborate ones must be used. On the other hand, measurements that are made to test the product itself in routine production must be simple and rapid in order to be economical.

Consideration is here given only to the testing of the functional conditions on the gears. The functional requirements of any pair of gears depend largely on the nature of the service which they are called upon to give. A gear drive may be called upon to transmit motion only. In this case, the tooth load may be little more than that needed to overcome the frictional resistance of the mechanism. In some cases, the accuracy required of the motion may be very high; in others, it may be of minor importance. To a great extent, such a difference in service requirements primarily affects the extent of the tolerance on certain features of the gears or the nature and amount of the permissible variations in the functional tests. No set of standards will ever be complete enough to fit all conditions of service. Some conditions will need only a part of the refinements specified in some standard; other conditions will need refinements beyond those specified in any standard. Each case should be studied by itself.

Again, a gear drive may be called upon to transmit power—sometimes more and sometimes less—at very high speeds, at very low speeds, or at intermediate speeds. Here again the differences in the nature of the service required will

primarily affect the extent of the tolerances on some of the features of the gears. Under the most extreme conditions of load or speed, or of both, additional functional tests may be required.

In the majority of cases of essential gear drives for all types of service, smoothness and uniformity of action are critical requirements. Smooth gear action is dependent not upon any single feature of the component but upon the composite action of several of these features acting simultaneously. For example, a larger spacing error may be permitted when the tooth profiles are perfect than can be tolerated when errors exist in the tooth forms themselves.

Functional Tests for Gears—Therefore most of the functional tests for gears consist of operating the gears from production either with a mating master gear on some form of test stand or else operating them with mating gears from production, or both. There are some gear-testing machines that compare the difference in the nature of the action between a pair of gears from production with that of a pair of accurate master gears, or that of a pair of pitch discs which drive each other by friction. Such tests give a direct measurement of the error in action, or a measure of the distance that the surfaces of mating gear teeth from production are displaced along the pitch line from the position that two perfect gears would occupy.

Such a test gives the most important functional information for every type of gear drive and for every condition of service. At present, the scope of this type of equipment is narrow; it does not cover all types of gears. In addition, it only covers a limited range of diameters of spur and helical gears of from about 2 to possibly 30 inches in diameter. These tests require the use of many special arbors, master gears, or special pitch discs, as well as considerable time to set up and operate the equipment.

Another and more common type of functional testing equipment for gears consists of a stand or special fixture on which the gears are mounted in their operating position. Sometimes a gear from production is meshed with a master gear, and sometimes a pair of gears from production are meshed together. On these test stands, the nature and the amount of the surface contact between the mating tooth surfaces can be determined by bluing the tooth surfaces of one gear and then examining the tooth surfaces of both gears after the teeth have been meshed together and operated by hand.

The same type of test fixture or stand is used when the gears are meshed and operated together by hand, the smoothness of operation being determined by feel. Some operators develop great skill in this operation, but the results are not always as definite as they should be. When the actual amount of the error in action can be measured, the maximum permissible error can be specified on the detail drawing. But even when the nature of the action is determined quite consistently by feel, the actual measure of the error cannot be evaluated and recorded on the detail drawing. The only reasonably consistent standard for this type of test is to have a pair of model gears, of known error in action, which represent the extreme conditions allowable, and then to mount and test this model pair periodically to establish for the operator a standard of feel.

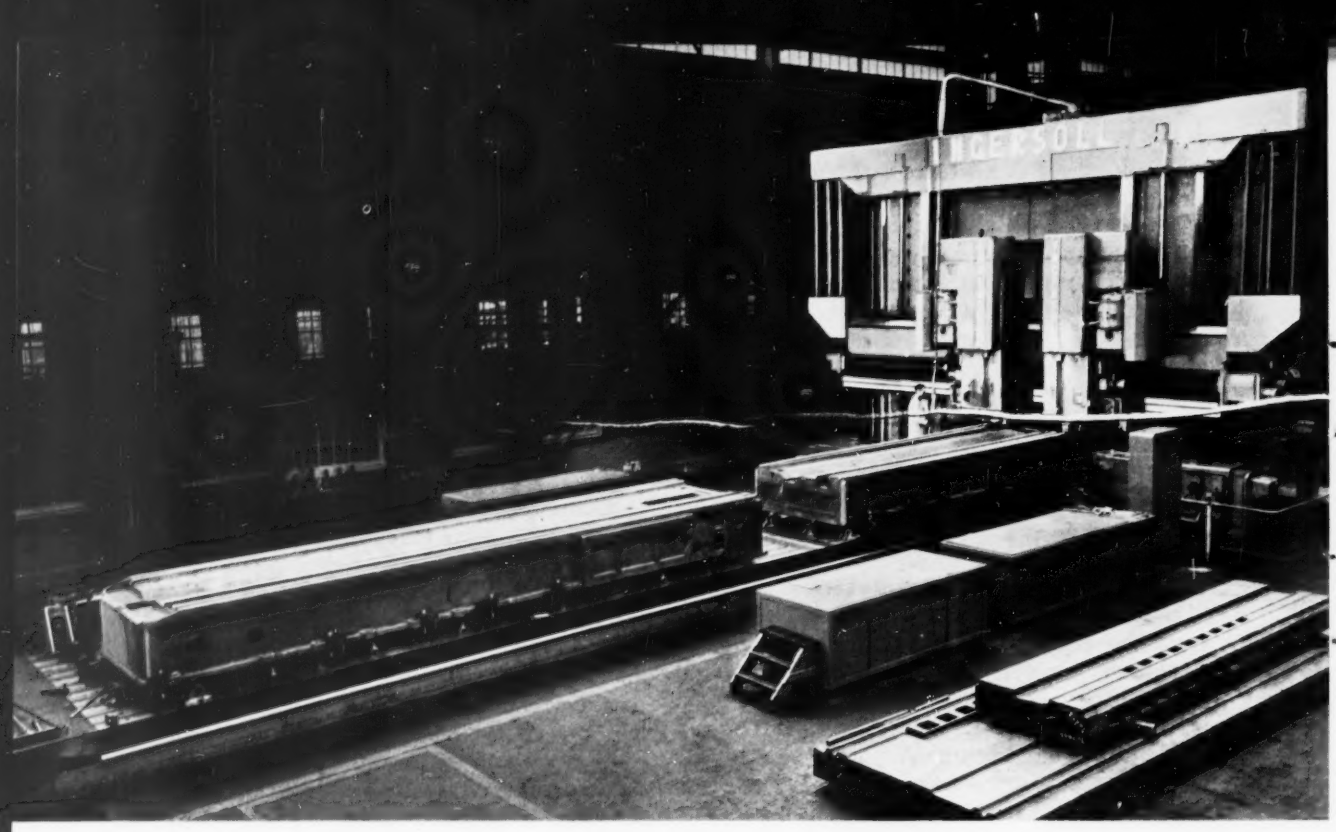
Another type of functional testing equipment for various kinds of gears consists of a stand on which a pair of gears can be mounted in their operating positions and operated by power under load. Here the noise of operation is taken as a criterion of their acceptability. When quietness of operation is an essential functional requirement of the product, such a test is a direct representation of this characteristic of the gears.

But with noise, it is not only the actual intensity of the sound—which can be measured with suitable instruments—but also the character of this sound which may be objectionable. For this last condition we have no other meter, as yet, than the human ear. Here again, the only possible standard or definite basis of comparison is a pair of model gears which represents the rejection limit of the noise of operation.

Experience has shown that when an inspector tests gears by ear, he instinctively compares them all with the best pair that he has listened to in the immediately preceding period. He expects them all to be as good as the best. If the first pair tested at the start of a period is very good, practically all of the gears tested immediately afterward will be rejected. If an exceptionally good pair does not appear early, a much larger number of pairs will be accepted. With a functional test of this type, however, no other specification than a note calling for comparison with the performance of the pair of model gears can be entered on the detail drawing.

Another type of functional testing equipment for gears consists of a stand on which a pair of gears is mounted in operating position and driven by power or hand at a slow speed and against a light load. One arbor is mounted on a movable slide while the other remains in a fixed position. The gears are held tightly meshed together by a spring that acts on the movable slide. As the gears revolve, errors in tooth form or thickness, in spacing, or in concentricity cause the slide to move in and out. The amount of

(Continued on page 211)



Largest Milling Machine is Important Research and Production Tool

A TWO-YEAR expansion program costing over $3,000,000 has recently been completed by the Ingersoll Milling Machine Co., Rockford, Ill. The program was the result of carefully considered, long-range planning based on both present and contemplated future demands for large, special machine tools, and was not influenced by defense requirements. Included in the expansion was the construction of what is believed to be the world's largest milling machine.

This huge, adjustable-rail milling machine, which is shown in the heading illustration, is 14 feet wide between housings and will accommodate work-pieces up to 12 feet high under the rail. The machine bed is 123 feet long, and the table 62 feet long. Weighing 1,150,000 pounds, the machine rests on a steel reinforced, concrete foundation. The dimensions of the foundation are 133 feet long by 42 feet wide and up to 11 feet thick. Approximately 870 cubic yards of concrete and 30 tons of steel reinforcing rods were used in the foundation.

An outstanding feature of the milling machine is the amount of power available for actually cutting metal. Three of the four milling heads on the machine—two vertical heads and a right-hand horizontal head—are each equipped with a 150-H.P. electric motor. A left-hand horizontal head is powered by a 250-H.P. motor. The motor mounted on the left-hand horizontal head can be overloaded up to 400 H.P. for periods of three minutes.

Another unique feature of the milling machine is that the table is constructed in two sections, one 27 feet long and the other 35 feet long. Both sections can be used as a unit, or either can be parked at one end of the machine, as seen in Fig. 1. When the sections are separated, work can be set up on one while parts on the other are being milled, thus minimizing "down" time on the machine. The table sections can be separated in about two minutes by means of air-operated wrenches.

Power shank rods are provided on all heads for quick, easy cutter changes. Practically all functions of the machine are controlled by push-buttons that are mounted on a convenient portable pendent. Even the spindle-speed gears in the vertical heads are rapidly changed by electrical means, and no hand-levers are provided. Separate electronic controls are furnished for the table, horizontal and vertical heads, and cross-

rail feeds. Rail clamps, too, are power-operated and electrically controlled.

Although the primary purposes for the machine were to permit the economical machining of large parts and increase production, it also was designed for research and experimental work. More efficient machining methods and better cutting tools are being developed. New ideas resulting from the operation of the machine are being passed on to customers, enabling them to increase production with existing equipment, and making it easier for them to justify investment in larger and more powerful machines.

With the ample power available on this machine, cutters can be designed to withstand extraordinary loads, and tested under actual production conditions. Cutter capacities have, in general, been ahead of machine capabilities, but now with ample power available this machine is actually ahead of present cutters. Teeth have been broken from some cutters during milling. Limitations of carbide cutting tools can be explored, and techniques for milling the new metals constantly being developed can be established with the power, rigidity, and size available on this research machine.

A set-up for rough-milling the top of a large cast-iron table for an Ingersoll machine is shown in Fig. 2. In this operation, up to 9/16 inch of stock is removed with 13-inch wide cuts at feed rates in excess of 60 inches per minute. Prior to the building of this huge adjustable-rail milling machine, the usual feed rate for rough-milling cast-iron table tops was in the neighborhood of 20 inches per minute. The tools shown in this and the other illustrations are Ingersoll heavy-duty milling cutters with carbide-tipped blades.

Major economies are possible when this machine is equipped with right-angle attachments. For example, as seen in Fig. 3, the use of such an attachment permits milling both ends of large castings (after milling the sides and top in the conventional manner) without the need for resetting the work. Also, accuracy of the workpiece can be held to closer tolerances when all cuts are taken in one setting of the work. In the operation shown, a 14-inch diameter, Ingersoll "Shear Clear" face mill with carbide-tipped inserted blades is taking a cut 1/2 inch deep and 12 inches wide.

Another example of the accuracy maintained was the production of a 74-foot long bed for a die-block milling machine. The bed was milled in three sections. First, it was machined lengthwise in the conventional manner, and then across the ends with a right-angle attachment. When assembled, without any hand scraping, it was within 0.003 inch of being straight over its entire 74-foot length.

If a part to be machined is too narrow to be reached by both horizontal heads at the same time, the problem can be solved by using the

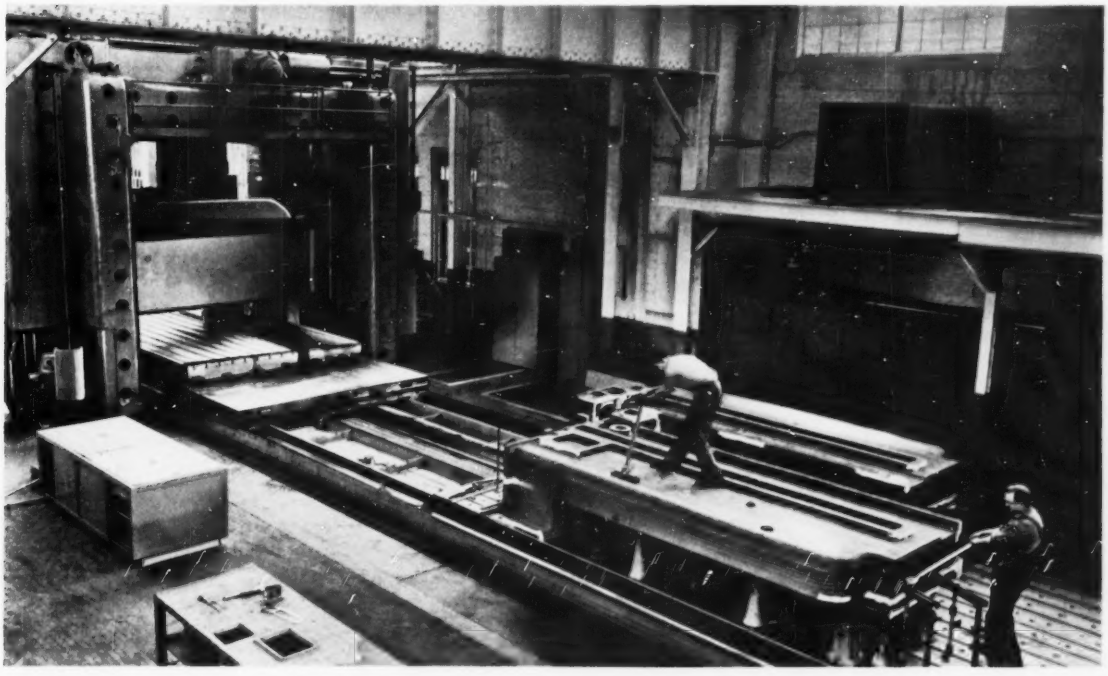


Fig. 1. Table on huge milling machine seen in heading illustration is constructed in two sections. One section can be loaded while work on the other is being milled.

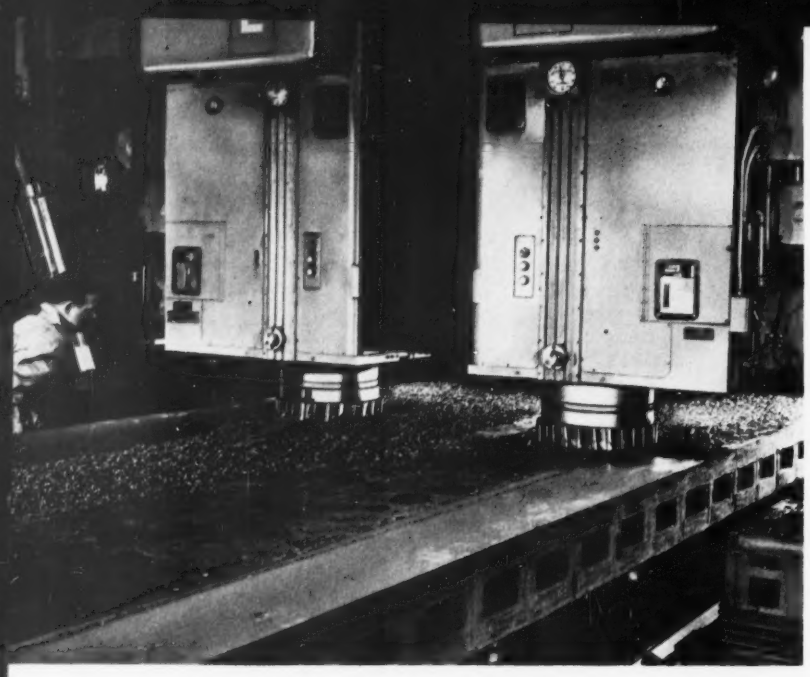


Fig. 2. Feed rates in excess of 60 inches per minute are used in rough-milling tops of cast-iron tables—more than three times the rate previously used on smaller, less powerful machine.

right-angle attachment, as seen in Fig. 4. Thus, a wide-bed machine is effectively converted into a narrow one, and time is saved that would be required to reset the work for milling each side separately with horizontal heads. In this operation, tubular ways are being milled near each side of a narrow casting with 4 1/2-inch radius form cutters having carbide-tipped inserted blades.

In Fig. 5, two right-angle attachments are being employed to slot a machine table. The slots, 1 1/4 inches wide and 3 1/4 inches deep, are cut two at a time with 24-inch diameter, carbide inserted-blade slotting cutters, at a feed rate of 20 inches per minute. This method has proved to be more accurate and faster than milling with a gang cutter set-up, which required much slower feed rates.

Right-angle and other attachments are neatly stored in covered floor pits at one end of the milling machine; required cutters are mounted on conveniently located racks; and work-benches containing the necessary set-up equipment are provided along both sides of the machine. This arrangement eliminates the need for operators to travel to tool-cribs or remote storage bins.

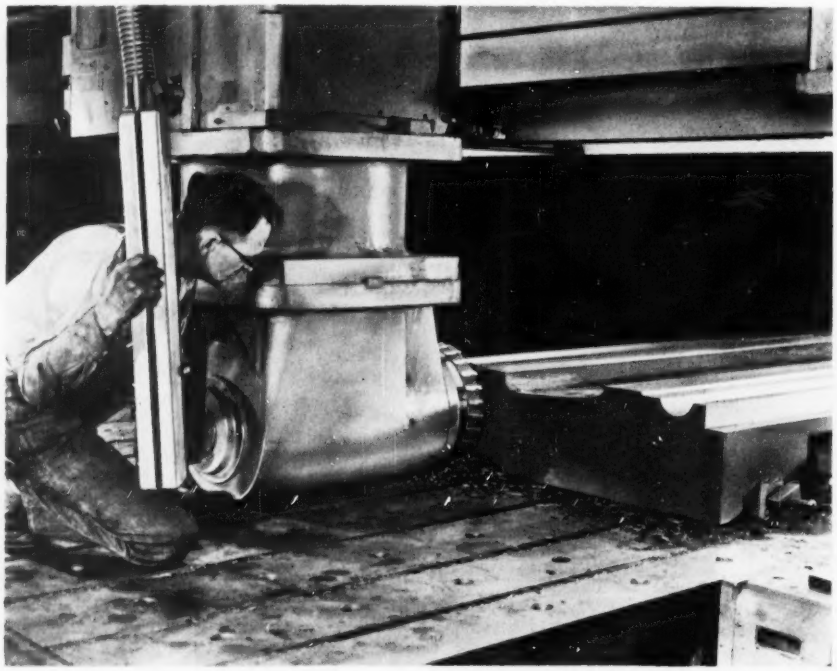


Fig. 3. Right-angle attachment permits milling both ends of large castings without the need for resetting the work, thus permitting closer tolerances.

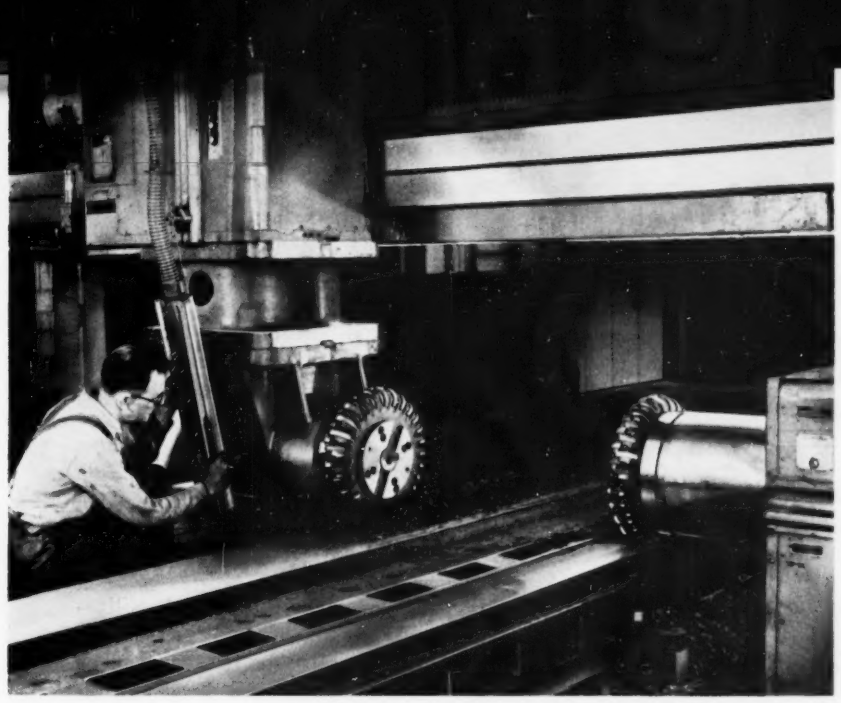


Fig. 4. Wide-bed milling machine is converted into narrow one by using a right-angle attachment. Here, tubular ways are being milled near each side of a narrow casting.

Paddle type chain conveyors for chip removal extend the full length along both sides of the machine, and the operators need only brush the chips from the table. Chips on these conveyors slide down chutes and are carried in tube conveyors to a centrally located disposal area outside the assembly department.

The large, adjustable-rail milling machine is located in the new erecting shop which was part of the expansion. This shop has a 42-foot high clearance in the bays and 18- to 36-inch thick reinforced concrete floors with built-in assembly pits, and is served by 40-ton cranes having 96-foot spans. These facilities permit manufacture of the extraordinarily large, heavy machines which are used for milling Diesel engines, turbine shells and rotors, die-blocks for producing aircraft parts, rolling mill and press housings, and other large castings.

One such machine, weighing 420 tons, was recently erected in the new shop in fifty-nine working days. When this machine, built for a large shipbuilding company, was on the assembly floor late in February, the two largest adjustable-rail milling machines in the world were within a few feet of each other.

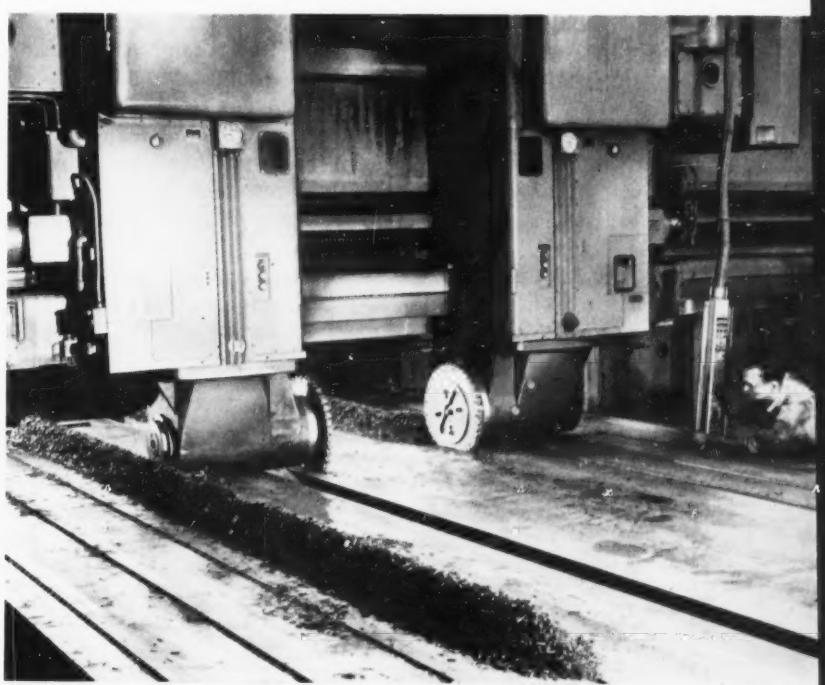


Fig. 5. Slots 1 1/4 inches wide and 3 1/4 inches deep are cut two at a time on this adjustable-rail milling machine which is equipped with two right-angle attachments.

How to Design Drill Jigs

Reduction in the manufacturing costs of duplicate parts for interchangeable assembly is the prime purpose of the drill jig. To accomplish this efficiently, the jig must be designed to function rapidly and maintain a high degree of accuracy over long periods of hard usage. First of two installments.

By H. C. TSIEN, President
Central Technical, Inc., New York City

PRINCIPLES involved in the design of drill jigs, although generally well known, are frequently overlooked or unintentionally violated. By mentally picturing a particular jig as it will be employed on the production line, a tool designer can draw upon his previous shop experience for design improvements affecting accuracy, practicability, cost, and safety. It is the purpose of this article to clarify some of the general design principles, discuss the various components and types of jigs, and present some ideas as to possible improvements of existing work-holding devices.

The clamping of fragile work-pieces, such as sheet-metal parts or tiny castings, presents a problem. This is especially true if the material is easily marred as when working with aluminum, zinc, or brass. To meet this situation, there are many types of swivel heads that can be used. Some of these may be seen in Fig. 1.

Also available are torque-limiting screws, such as seen in Fig. 2, which prevent distortion when clamping against thin sections. The torque may be varied by means of a small adjustment screw *A*, shown at X. In use, the knurled head will slip freely when the pre-set torque is reached, thus preventing the build-up of excessive pressure.

Several styles of this type screw are obtainable, three of which are shown at Y in the illustration. The one shown at the top is a regular type, pressure being applied to the work-piece by the rounded end of the threaded body. An inverted type is shown immediately below. With this screw, the work is supported by a protuberance *B* on the head. The lower screw is called a T-head, since the end of its body is machined to fit into the T-slot of a sliding V-block.

A clamp that can be used to secure two parts of slightly unequal lengths is shown at X in Fig. 3. When clamping pressure is applied by knob *A* to the lower (shorter) link *B*, pressure is directed to screw *C* at the center of the long link *D*. Pressure is thus equalized against both work-pieces. To limit movement, a pin *E* is provided in clearance holes drilled through both links.

A less elaborate method may be seen at Y. In this set-up the face of a square swivel-head *F* is machined to form two contact ridges. The head is mounted on the machined end of a clamp-screw and is held in place by means of a single pin *G*. This pin acts as an axis about which the head can pivot slightly, thereby tending to apply equal pressure to both parts. A square post *H* is located adjacent to the swivel head to prevent it from rotating, thus keeping the ridges horizontal.

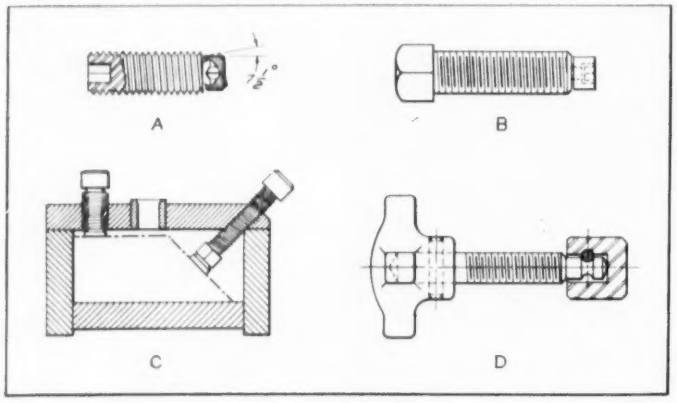


Fig. 1. Many styles of swivel screws are commercially available to prevent damaging the surface of soft work-pieces when tightening screw type clamps.

Considerable operator fatigue can be eliminated by utilizing built-in air clamps. The small amount of space required and the low cost involved are not generally realized. A typical air clamp set-up is shown in Fig. 4. Cold-rolled steel stripper stock forms the base in which is bored a cylindrical cavity *J*. Into this cavity is fitted a cold-rolled steel piston *K* containing an O-ring *L* as an air seal. Air, compressed to a pressure ranging from 80 to 100 pounds per square inch, enters the cylinder through port *M*, causing the piston to rise. Clamp *N* pivots about the spherical end of special stud *O*, thus causing the right-hand end to lower for locking. Nut *P* is pinned in place to prevent unauthorized adjustments of the stud in the shop. A stop-pin *Q* is provided as a safety precaution against crushed fingers. Both the stud and the piston are spring-loaded.

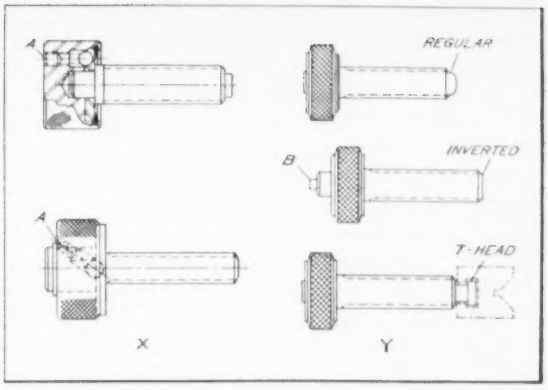


Fig. 2. Two types of adjustable torque-limiting screws are shown at X. Three styles in which these screws are obtainable may be seen at Y.

Many Jig Components are Commercially Available

It will invariably prove more economical to incorporate in the jig design parts that are commercially available or that can be easily modified from commercial parts. As an example, low-carbon steel stripper plates are available with both faces ground and polished to a thickness tolerance of plus or minus 0.003 inch. Edges of the plates are machined rather than sheared, thereby insuring parallel sides that are free from strains. Warping and distortion after machining are practically eliminated.

For large work where the weight of the finished tool is of prime consideration, aluminum jig plates can be purchased. The plates are claimed to be flat within 0.005 to 0.007 inch. Slightly higher costs of these specially prepared plates is well justified. However, care should be exercised to maintain the same rigidity as an equivalent steel plate to prevent warpage.

Other commercial parts include various clamp assemblies such as the heel-pin, hand-knob, or cam-heel types. Also to be considered are quarter-turn screws, C-washers, spherical washers, spherical-head nuts, swing bolts, jack-locks, and quick-acting screw pushers.

Locating Devices Assure Accurate Work Positioning

An extremely important requirement in the design of a drill jig is the provision of adequate facilities for locating the work. In general, three locating points are used for positioning the work-piece, two bearing against the longer edge of the part and one against the shorter edge. Clamping of the part should be done in line with the locating points so that no deformation occurs.

A commonly used method of work location is by means of dowel-pins or studs. This type of set-up, as shown at W in Fig. 5, is a satisfactory

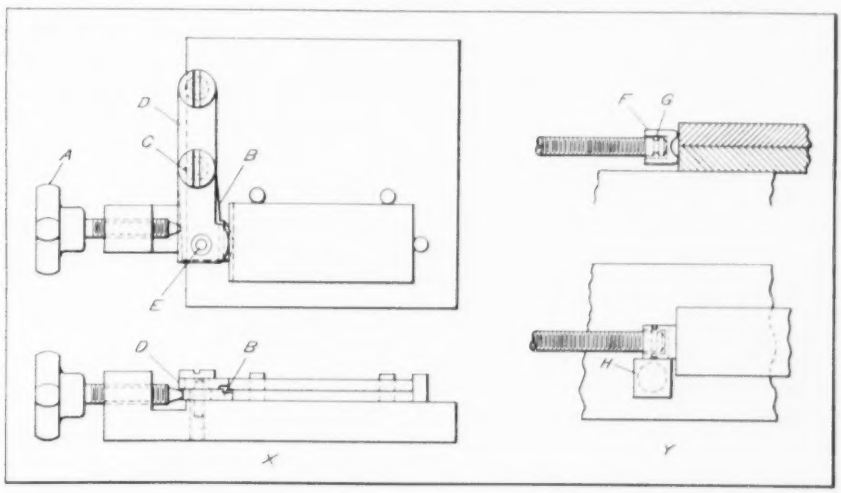


Fig. 3. Either of these clamping devices can be used to hold two parts of slightly different lengths against locating points.

arrangement for small-quantity production when the work-piece is of a hard material. The reason is that the edges of the pins will mar a soft material and cause inaccurate hole location. Three arrows in the illustration indicate the points and direction of clamping.

Improved locating conditions may be had by employing either of the designs shown at X and Y in the illustration. In both cases, the contact pressure is distributed over comparatively larger areas, thereby allowing a substantially larger clamping force to be applied.

Nesting is still another method of locating. If the work-piece is positioned in a nest, as shown at Z (Fig. 5), it is important to relieve all the unnecessary edges, leaving only those strategic points, or edges, from which the dimensions of the holes will be controlled. Relief of unnecessary areas will facilitate the loading and unloading of the jig. Foolproof pins may be added so that it will be impossible to insert the part in any but the correct way.

Conventional jigs should always be provided with feet on the sides that are opposite the bushing holes. The importance of this arrangement is often underestimated. Jig feet may be either soft or hard. Most shops object to the use of soft feet as chips tend to get caught under them, thus impairing the accuracy of the drilled holes. Other shops, however, refuse to use hardened feet, claiming that they might damage the surface of the drill press table.

This reasoning is not justified. The legs should be pack-hardened to a case depth ranging from 0.035 to 0.040 inch, extending upward approximately 1/2 inch from the resting surface. Drill rods do not make satisfactory feet because they are too brittle to withstand rough usage. The practice of screwing hardened steel strips, or buttons, to the base of the jig should be avoided, as the sockets of the screws tend to trap loose chips.

Many design features are subject to the individual taste and judgment of the tool designer, the facilities of the shop, and the preferences of the foremen involved. Certain controversies are bound to arise from time to time regarding various aspects of jig construction.

One problem that frequently presents itself is the question of drilling against clamps. Generally speaking, this practice should be abandoned wherever possible because the drilling pressure may loosen the clamp and cause shifting of the holes. This rule should not be deemed hard and fast, however, as there are exceptional cases where drilling against clamps is the only way to substantially reduce the cost of a jig, or to provide proper location for the work. If, as in the majority of cases, no pressure is exerted against the clamps, a spring plunger similar to the one shown in Fig. 6 can be used.

Screw and dowel construction as opposed to welding is another question over which good judgment should prevail. A satisfactory, prac-

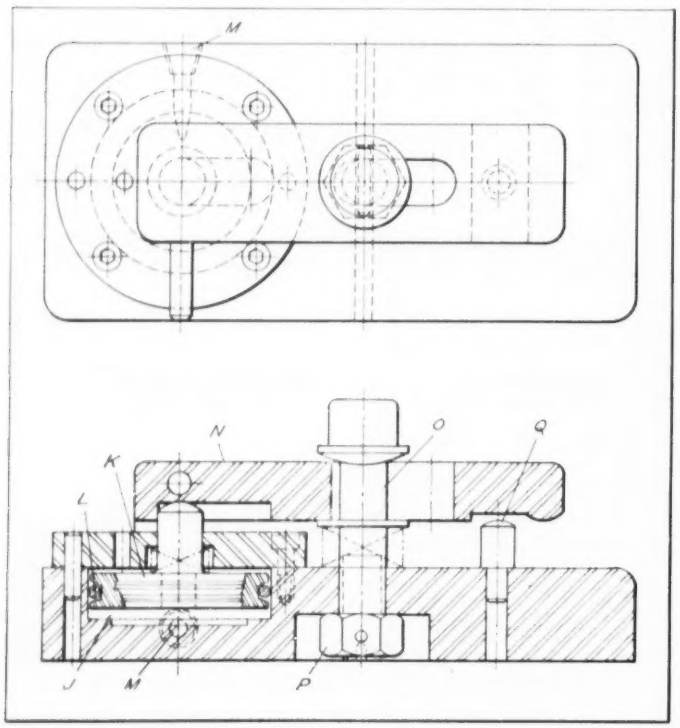


Fig. 4. Built-in air clamps allow loading and unloading to be accomplished in a minimum of time. Additional advantages are their low cost and small space requirements.

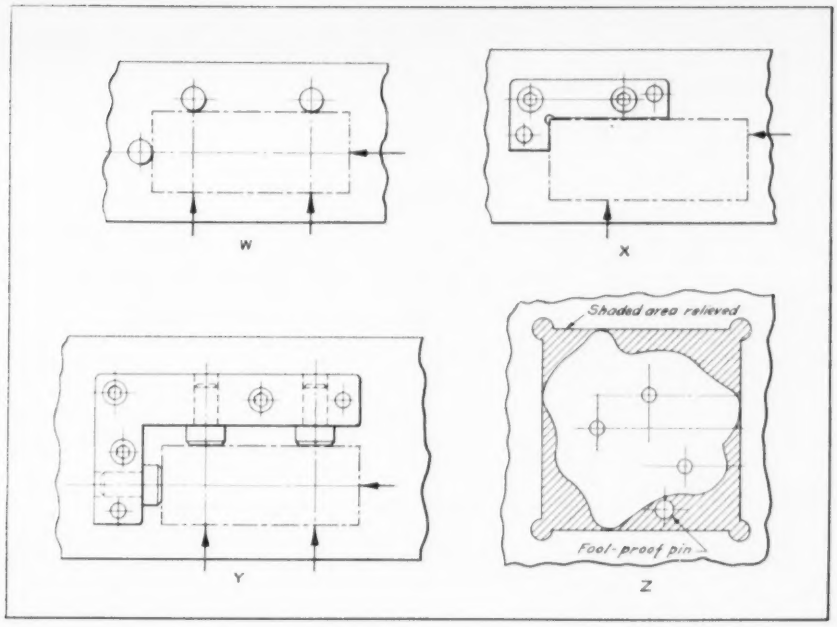


Fig. 5. Locating pins shown at W can be employed satisfactorily with hard work-pieces, but the set-ups shown at X and Y are preferred. Nest type of location, as seen at Z, is also used extensively.

tical compromise is to weld the members into sub-assemblies, after which the sub-assemblies are screwed and doweled together to form the completed tool. This type of construction provides adequate accessibility to the various major components for grinding and other servicing.

There are numerous types of drill bushings from which a tool designer can make a selection to suit any particular job. In cases where drilling is to be followed by reaming, tapping, or counterboring, the practice has been to use renewable slip bushings inserted into liner bushings. The slip bushings, being loose pieces, can easily be mixed up and even lost. In work-pieces requiring many holes, it is preferable to have the bushings color coded.

Many modern shops prefer to use head type press-fit bushings in conjunction with step-drills. With proper tool-room facilities for sharpening the step-drills, concentricity between the drill margins and the pilot can be easily maintained. Head type bushings are preferred because they take up the drill pressure and prevent the bushings from being knocked out.

Several conventional types of drill jigs will be described in the concluding installment of this article to be published in the June number of MACHINERY.

* * *

First Nickel Coin

The first pure nickel coin ever issued was a 20-centime piece minted by Switzerland in 1881.

Method of Purifying Water Provides Bacteria-Free Coolant

A new means of purifying water may eventually have an important application in machine shops. The Hyla process, as it is known, is a catalytical water treatment employing complex silver salts deposited on a common carrier material. Salem-Brosius, Inc., Pittsburgh, Pa., are developing the process and sponsoring related research at Johns Hopkins University. The residual killing ability of Hyla permits it to keep water free from contamination long after being purified.

The process lends itself admirably to municipal water systems and to various industrial applications. In the machine shop, skin infections resulting from bacteria-contaminated coolant systems can very likely be completely prevented by filtering the coolant or adding Hyla-treated water to the shop reservoir.

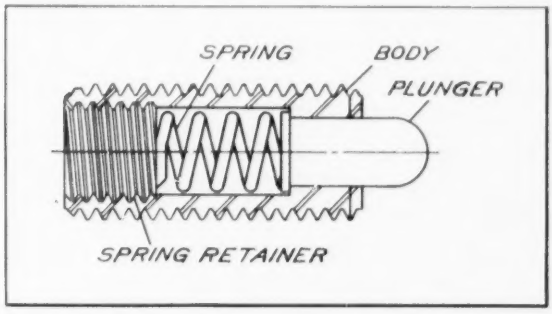
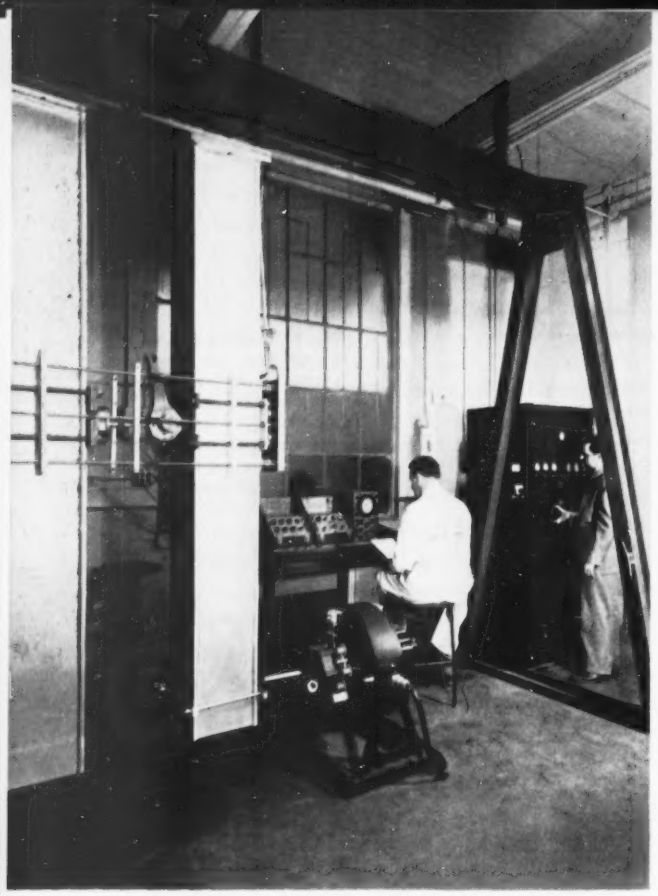


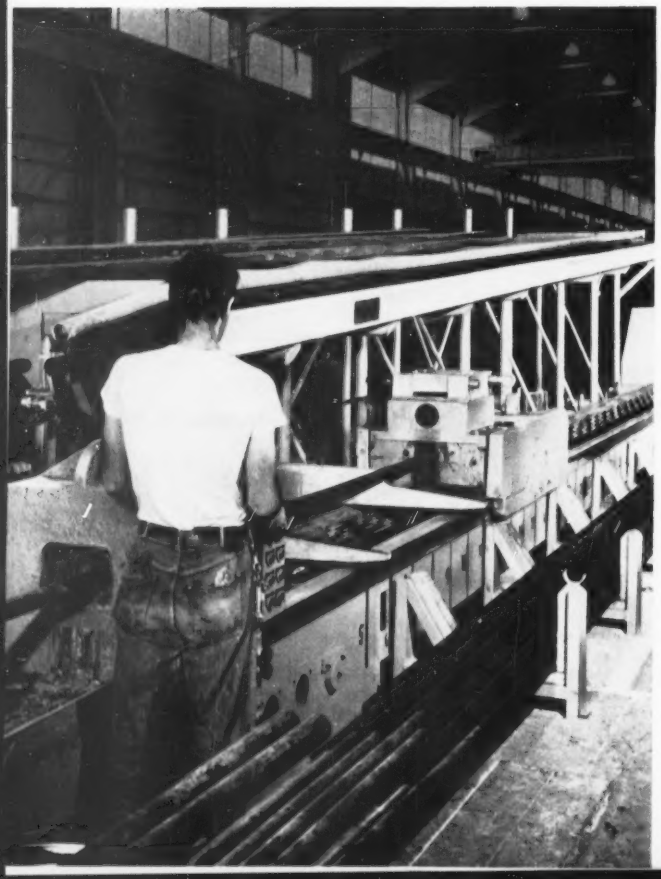
Fig. 6. Spring plungers may be employed in cases where no drilling pressure is applied against the pushers. These plungers are commercially available.

In Shops Around

Camera highlights of some interesting operations performed in various metal-working plants throughout the nation



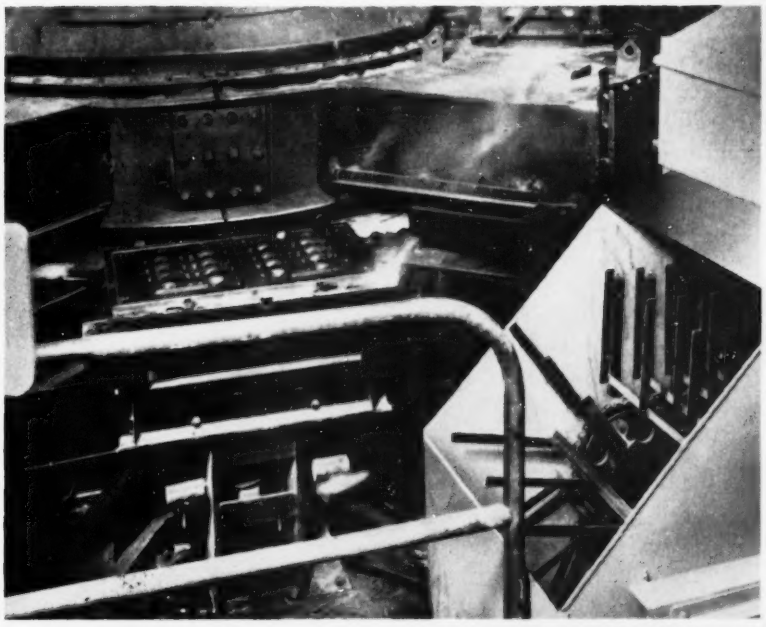
Performing a resonant fatigue test on an airplane engine master rod with a large "tuning fork" at the Weber Instrument Co., Detroit, Mich. The specimen is mounted between the tines of the fork, to which is coupled a vibration exciter. Through tie-rods, compressive loads are transmitted to the tines and specimen. A change in the vibratory system indicates specimen failure.



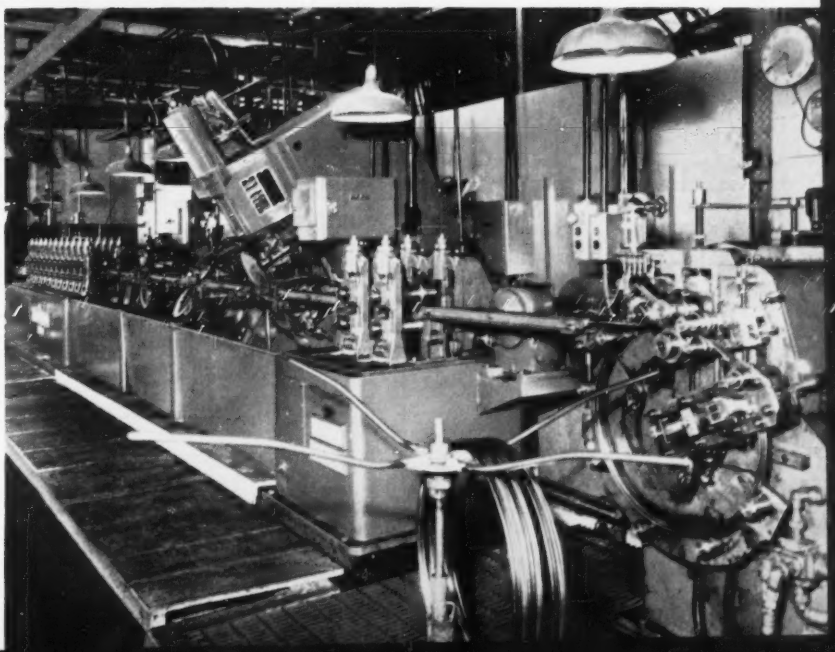
Producing steel tubing on a new 150,000-pound draw-bench at the Pacific Tube Co., Los Angeles, Calif. The bench, claimed to be the largest West of the Mississippi, was built by the Aetna-Standard Engineering Co. Of a single-chain, double-mandrel type, it can draw tubing at 110 feet per minute to a length of 52 feet and an outside diameter as great as 6 1/2 inches.

the Country

(Right) Die sets are now made on these two new production lines at Danly Machine Specialties, Inc., Chicago, Ill. Adapting the many standard sizes and shapes of die sets to mass-manufacturing techniques required a high degree of interchangeability in the design of work-fixtures.



A shell mold made of sand bonded by Bakelite phenolic resins leaves the ejecting station of a rotary mold-making machine at the Walworth Co., Boston, Mass. Simultaneously at other stations, patterns are preheated, molds are cured, and the resin-sand mixture is poured on the patterns.



Forming and welding bicycle rims at the Canada Cycle & Motor Co., Ltd., Weston, Ont. Flat strip is fed into the 40-foot long production line at a rate of 35 feet per minute. Formed to shape, edges are folded together and resistance seam-welded by three Taylor-Winfield machines.

Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

Strong Aluminum Alloy Is Given Pressure Vessel Code Approval

The use of aluminum alloy GR40A (A.S.T.M. designation) for the construction of unfired pressure vessels in accordance with the rules of Section VIII of the 1952 A.S.M.E. Boiler and Pressure Vessel Code has been disclosed by the Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.

This alloy, designated A54S by the company, offers higher mechanical properties than any of the alloys previously approved for welded pressure vessels and permits the use of higher allowable design stresses. For elevated temperature operation, the alloy becomes even more desirable because it maintains its strength better at higher temperatures. Although the alloy can be welded by all conventional methods, the semi-automatic inert-gas metal-arc process and the inert-gas metal-arc process (tungsten-arc) are preferred.

Although the alloy is more expensive than 3S and 4S alloys on an equal weight basis, it is definitely more economical on the basis of equivalent strength. The weight saved in vessels fabricated from this alloy will normally more than offset the increased cost per pound, and the lighter weight in itself is often a valuable advantage in construction.

Water-Repelling Leather Belt Preservative Exhibits Long Life

A leather belt preservative which gives long service and requires only infrequent application has been announced by the Viscol Co., 18 East Ave., Bridgeport, Conn. This preservative, called Clarol, contains no oil, grease, or resin, and will not turn rancid. Applied by brush, spray, or oil-can methods, it penetrates and acts as a lubricant for the fibers. It "sets" in the leather to form a gelatinous structure which does not creep to the surface. Clarol actually repels water and steam, rendering the belt water-proof without closing the pores to the air. Since belts treated with this preservative do not slip, they can be run slack.

Low Melting-Point Cement Binds with Light Pressure

An industrial adhesive, so sensitive that it takes only fingertip pressure to join materials together, has been made available by the Cycleweld Products Division of Chrysler Corporation, Detroit 31, Mich. This liquid adhesive will permanently fasten rubber, metals, wood, plastics, ceramics, or fibers together in any combination. Extremely stable, it completely resists attack by salts, alkalis, acids, moisture, or solvents. The cement has already been adopted for use in building heavy machinery, radar, electronic equipment, and aluminum honeycombed panels for aircraft wings, fuselages, and stabilizers.

Abrasive-Filled Plastic Imparts Non-Skid Properties to Floors

An abrasive-filled plastic coating for floors which brushes on like paint in one simple application and dries to a thickness that is twenty times thicker than a conventional two-coat paint job is being marketed by Colonial Refining & Chemical Co., National Broadcasting Co. Bldg., Cleveland 14, Ohio. This coating, called Sure Grip, is now being employed to eliminate spills and falls that result in injuries and time losses. It dries within ten hours after application and resists the action of gasoline, oil, alcohol, and water. It is available in two colors—red or gray—and may be applied to wood, metal, or concrete surfaces.

Rosin-Flux Solder Composed of Three Components

The availability of Cen-Tri-Core energized rosin-filled solder, which is a rosin-coated solder wire covered with an outer solder sleeve, has been announced by Alpha Metals, Inc., 56 Water St., Jersey City 4, N. J. This unique construction makes it possible to provide a solder wire with no flux voids and a means whereby flux can be made to flow ahead of the molten solder, thereby assuring less waste of material. Despite its high activity, the rosin is non-corrosive and electrically non-conductive.

Stainless-Steel Metal Powder for Fabrication of Parts

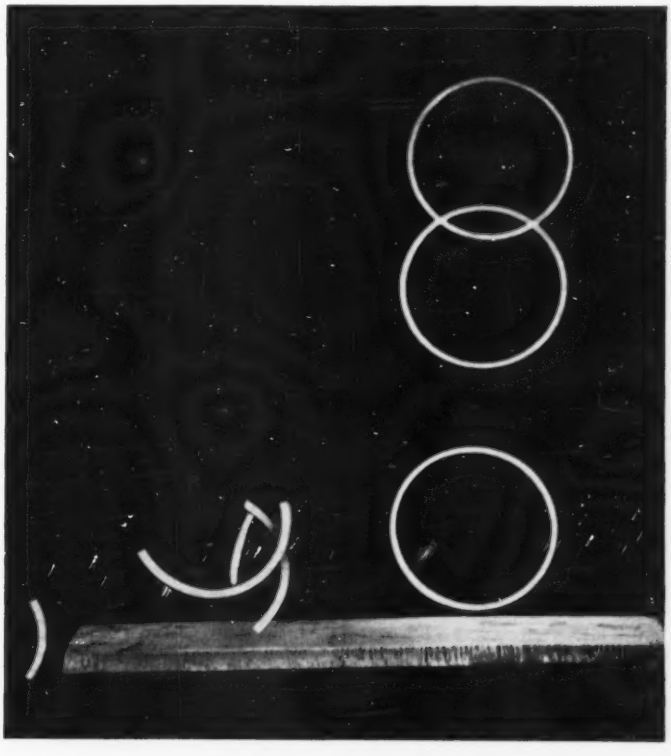
The availability of a new type of stainless-steel metal powder, called Stain-Alloy, has been announced by Alloy Metal Powders, Inc., 238 Eagle St., Brooklyn 22, N. Y. The metal powder can be used by fabricators of gears, self-lubricated bearings, welding alloys, bushings, and small precision mechanical parts, as well as for conventional sintered parts. Advantages claimed for this stainless-steel powder are that it is resistant to intergranular corrosion of the sintered compact; molded at compacting pressures of 30 to 50 tons per square inch; and sintered at 2100 degrees F. Stain-Alloy is a bright free-flowing powder, all particles of which pass through a 150-mesh screen, and approximately 60 per cent of which will pass through a 325-mesh screen.

Hot-Melt Strippable Coating Resists Darkening by Heat

A hot-melt, strippable coating that exhibits no oil exudation up to temperatures of 160 degrees F. is being manufactured by the Fidelity Chemical Products Corporation, 470-474 Frelinghuysen Ave., Newark, N. J. This material, called Dip-Pak No. 661, is transparent, clear, and extremely resistant to darkening under heat. A fairly tough, rubbery, thermoplastic compound, it will remain flexible at temperatures ranging from —50 degrees F. to 160 degrees F. It functions as a semi-permanent coating for metal objects, as a strippable coating for metal, as an insulating and potting compound for objects not subjected to heat in excess of 160 degrees F. and as a plating stop-off. This compound offers excellent resistance to corrosion. Its melting temperature is 360 degrees F. The application range is from 320 to 350 degrees F.

Close-Tolerance Strip Material Made of Beryllium Copper

A close-tolerance grade of beryllium copper strip, known as Microstrip, has been announced by Penn Precision Products, Inc., 501 Crescent Ave., Reading, Pa. Available thicknesses run from 0.001 to 0.032 inch, with minimum tolerances ranging from plus and minus 0.0001 inch to plus and minus 0.0004 inch, depending upon thickness. On widths from 3/32 inch to 5 inches, width tolerances of plus and minus 0.001 and 0.002 inch are regularly held. During the manufacture of this strip, special care is used in solution annealing and surface conditioning, since correct annealing insures uniformity of hardness, formability, microstructure, and aging response, while freedom from surface oxides reduces die wear and contact resistance.



Two cast-iron pipe sections that were dropped from a height of 20 feet are shown photographed shortly after contact with a steel plate. The one on the left broke due to the impact; the other rebounded upward in a bounce pattern (as can be seen from the subsequent stroboscopic photographic exposures). The pipe section on the left was an ordinary gray iron section, whereas the one on the right was made from Ductile Iron, an alloy recently developed by the International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.

Recommendations for Chip-Breakers

PROBLEMS relating to the rate of chip formation, amount of chips produced, and change in the character of the chip, when using modern high-powered machine tools with cutting tools of cast alloys or sintered carbide, can be solved by the application of efficient chip-breakers. Since basic factors in the design of efficient chip-breakers have not been clearly understood, a comprehensive research project was jointly undertaken by a number of machine tool companies under the auspices of the National Machine Tool Builders' Association.

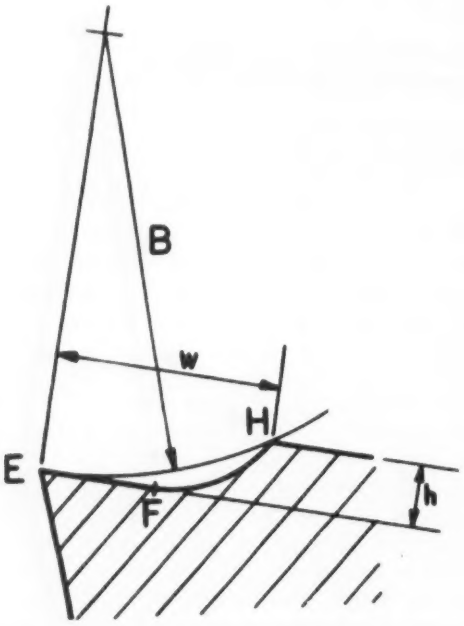


Fig. 1. Cross-sectional view of a chip-breaker showing principal dimensions. Section (EF) is the floor, and (FH), the heel.

This research project (described in December, 1953, MACHINERY, page 206) was conducted during the last two years by Professor Erik K. Henriksen at the Sibley School of Mechanical Engineering of Cornell University. Professor Henriksen is now with the Department of Mechanical Engineering, University of Missouri.

Results of the project, and recommendations for efficient chip-breakers, have been published in a comprehensive booklet entitled "Chip Breakers." Also, a 22 1/2- by 35-inch wall chart printed in four colors has been prepared to give simple directions on the optimum shape of the tool, including angles of rake and clearance and the dimensions of the chip-breaker. Copies of the report and of the wall chart may be secured from any of the sponsoring machine tool companies (listed in the December article) or the National Machine Tool Builders' Association, 2071 E. 102nd St., Cleveland 6, Ohio. Some of the recommendations contained in the report and chart are presented in this article.

Principal dimensions of the cross-section of a chip-breaker are illustrated in Fig. 1. From the cutting edge E, the face of the tool extends back to F, forming the floor of the chip-breaker that carries the cutting pressure from the chip. The rising part of the chip-breaker from the floor F to the heel H is called the slope. This slope lifts the free end of the chip up and over the heel each time a new cut starts. Pressure from the heel causes the chip to bend into a circle, called the chip flow circle or circle of bending, which has a radius of bending B.

Size and location of the chip flow circle are determined by the location of the heel H relative to the floor EF—or, in other terms, by the width w and height h of the chip-breaker. Regardless of the width or height, the chip will be broken in practically the same way if the radius of bending B is the same. The desired degree of chip-breaking is obtained, therefore, by the proper choice of the radius of bending B.

If the chip-breaker produces a snarling chip instead of one that is well broken, the breaker is too open (the radius of bending B is too large). It should be replaced by a tighter chip-breaker with a smaller radius of bending. The relationship between radius of bending B, width w, and height h is

$$B = \frac{w^2}{2h} + \frac{h}{2}$$

This relationship is also given in the accompanying graphs—Fig. 2 being for annealed alloy steel (AISI 4140), Fig. 4 for carbon steel, and Fig. 5 for free-machining steel (AISI B-1112). These three charts give chip-breaker dimensions for tools having side cutting-edge angles from 0 to 15 degrees, operating at cutting speeds from 400 to 1000 feet per minute, and taking depths of cut from 0.100 to 0.300 inch.

From these charts, one can determine the best chip-breaker for a given feed, or the preferable range of feeds for a given chip-breaker. It is evident from the charts that the preferred range of feeds for a given chip-breaker is narrow, and may be economical only for production tools. Since there is no known method for widening the preferred range itself by changing the

design of the chip-breaker, the only solution for general-purpose tools is to accept some types of chips outside the preferred range. This is called the usable range and is indicated by broken lines on the charts. The types of chips produced are shown at the right of the charts.

Tool wear tends to increase near the upper limit of the usable range, and beyond this limit there is danger of frequent tool failure. For the best tool life, h and B should be chosen as large as possible, consistent with a loosely curled chip, broken just enough for convenient handling and disposal. All chart data are for dry-cutting. The use of coolant may increase chip-breaking slightly, but can be ignored for design purposes.

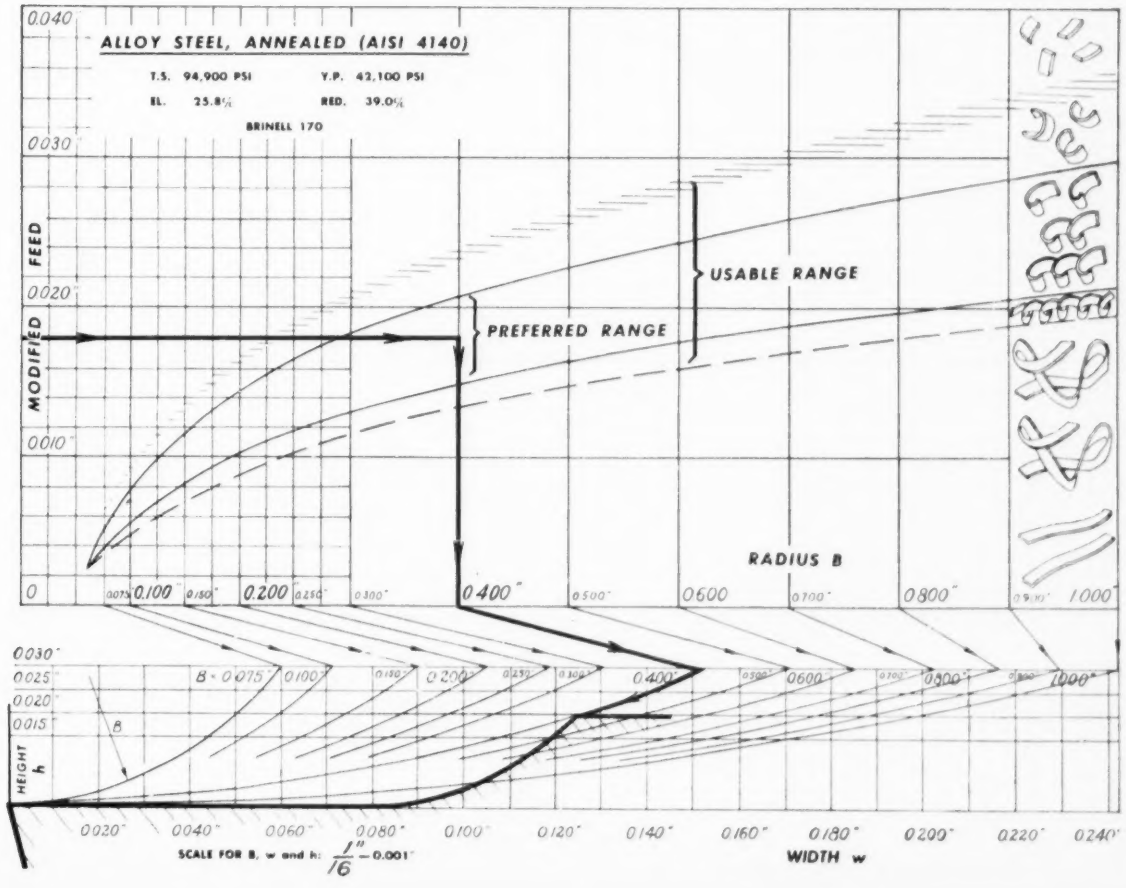
Although chip-breaking and the types of chips produced are controlled essentially by the combination of the feed and radius B, they are also influenced by the material being machined, the side cutting-edge angle of the cutting tool, the cutting speed, and the depth of cut. In Figs. 2, 4, and 5 are shown the effect of feed for three representative steels. The modification chart, Fig. 3, shows the influence of other conditions.

As an example of the use of the charts, it can be assumed that AISI 4140 steel is to be machined at a cutting speed of 350 feet per minute with a depth of cut of 0.125 inch, a feed rate of 0.022 inch per revolution, and a cutting tool having a side cutting-edge angle of 45 degrees. Starting with the actual feed rate of 0.022 inch per revolution at the upper left in Fig. 3, a horizontal line (shown solid) is followed until it intersects the 45-degree side cutting-edge angle line. Then a vertical line is followed down to the intersection with the line representing a cutting speed from 300 to 399 feet per minute. A horizontal line is then followed to the right, to the intersection with the line representing a feed rate from 0.100 to 0.299 inch per revolution. Proceeding down, the modified feed is found to be 0.018 inch per revolution.

Referring to the chart for AISI 4140 alloyed steel, Fig. 2, a horizontal line from the modified feed of 0.018 inch per revolution is followed to the middle of the preferred range. Moving down vertically, radius B is found to be 0.400 inch. Proceeding diagonally downward to the right to the 0.400-inch radius circle and selecting a height h of, say, 0.020 inch, width w is found to be 0.125 inch.

As another example, assume that carbon steel

Fig. 2. Chart giving chip-breaker dimensions for machining annealed alloy steel (AISI 4140). An example described in the text, and shown by heavy lines, indicates that (B) is 0.400 inch, (h) is 0.020 inch, and (w) is 0.125 inch.



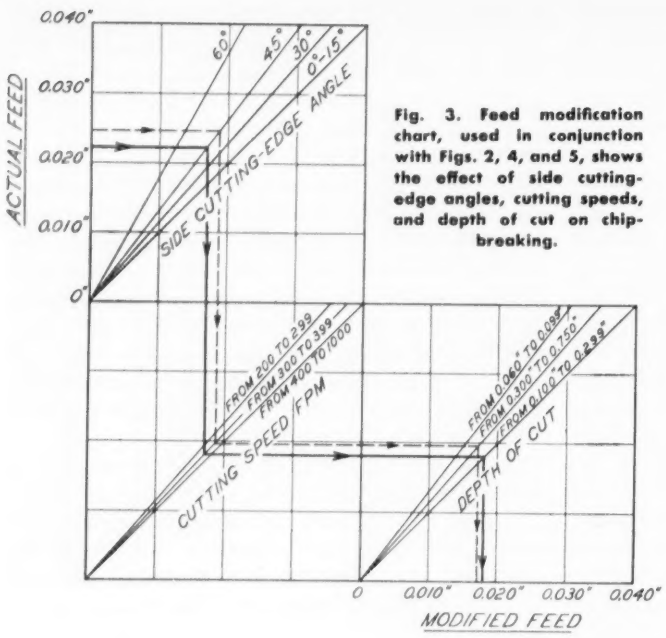
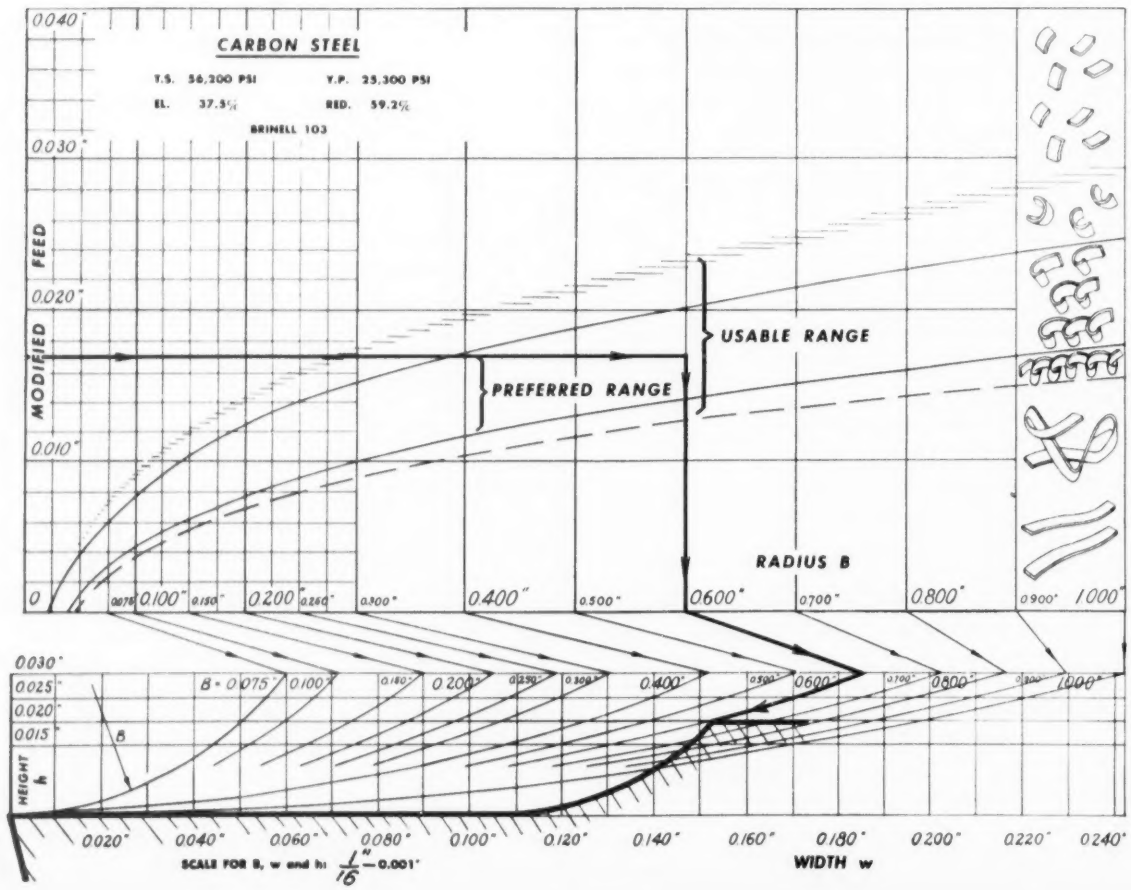


Fig. 3. Feed modification chart, used in conjunction with Figs. 2, 4, and 5, shows the effect of side cutting-edge angles, cutting speeds, and depth of cut on chip-breaking.

is to be machined at a cutting speed of 340 feet per minute, with a depth of cut of 0.500 inch, a feed rate of 0.025 inch per revolution, and a cutting tool having a side cutting-edge angle of 45 degrees. Starting with the actual feed rate of 0.025 inch per revolution at the upper left in Fig. 3, and following the broken lines, a modified feed of 0.017 inch per revolution is found. Referring to the chart for carbon steel, Fig. 4, radius B is determined as 0.600 inch. Selecting a height h of 0.020 inch, width w is found to be 0.152 inch.

A very important factor in good chip-breaker performance and satisfactory tool life is the shape of the slope. A large heel angle, HA in Fig. 6, results in smoother chip flow with less pressure and friction as the chip passes over the heel H. A satisfactory range for the heel angle is between 35 and 50 degrees. Above this limit, the chip-breaker is too flat; below, it becomes loaded with scrapings.

Fig. 4. This chart and Figs. 2 and 5 apply to tools having side cutting-edge angles from 0 to 15 degrees, operating at cutting speeds from 400 to 1000 feet per minute and cut depths from 0.100 to 0.300 inch.



Generally, the over-all size of a chip-breaker should be selected in proportion to the size of the tool itself. For tools with a shank less than 3/4 inch high, a chip-breaker height of 0.015 to 0.020 inch is recommended. Tools from 3/4 to 7/8 inch high should have chip-breaker heights of 0.020 to 0.025 inch, and tools larger than 7/8 inch should have chip-breaker heights of 0.025 to 0.030 inch.

In grinding the chip-breaker, a fillet radius equal to the radius on the grinding wheel is produced. The geometrical relationship between the height h, the fillet radius R, and the heel angle HA is

$$\sin HA = \frac{R - h}{R} = 1 - \frac{h}{R}$$

Too large a fillet radius (produced by a worn grinding wheel) makes the chip-breaker too flat. On the other hand, too small a fillet radius creates a serious stress concentration.

When the smallest possible chip-breaker is desired, a height of 0.015 inch is recommended, with a fillet radius on the wheel of 0.035 inch. Wear on the grinding wheel may increase the fillet radius to 0.065 inch without exceeding the upper limit of the heel angle. For large chip-breakers, the height recommended is 0.025 to 0.030 inch, and the fillet radius should be not less than 0.060 to 0.070 inch nor exceed 0.100 to 0.125 inch. The tolerances recommended for the principal chip-breaker dimensions are ±0.002 inch for h and ±0.004 inch for w.

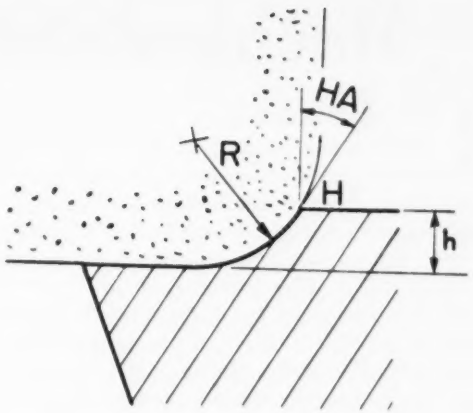


Fig. 6. Cross-sectional view of a chip-breaker showing the relationship between fillet radius (R) and heel angle (HA) produced by grinding wheel.

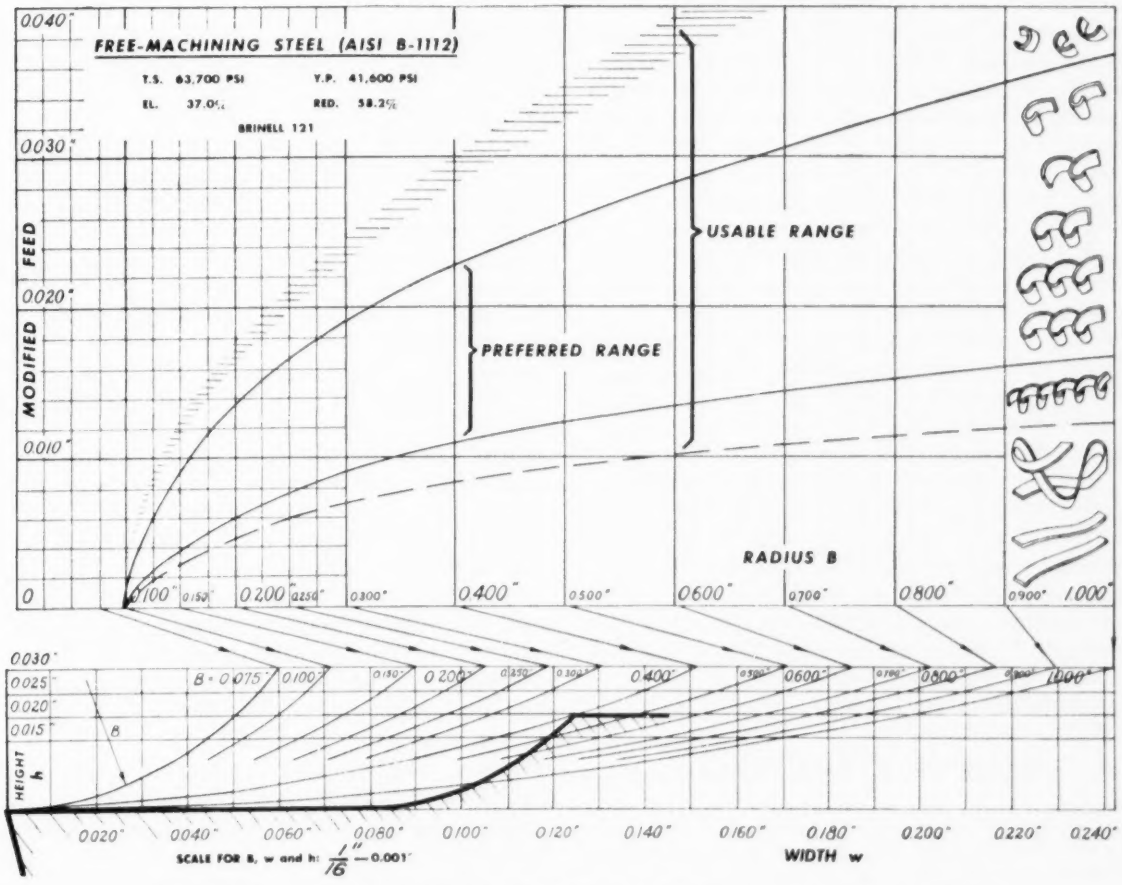


Fig. 5. Effect of feed on chip-breaking and the types of chips produced when machining AISI B-1112 free-machining steel. Influence of other operating conditions is shown in Fig. 3.

Machinability of Titanium

RECOMMENDATIONS for machining titanium is the subject of the third volume in the series of studies on machinability prepared by the Curtiss-Wright Corporation in cooperation with the United States Air Force. Some of the suggestions contained in the book are presented in this article.

The major reasons for difficulty in machining titanium are (1) a surface action resulting in unusual abrasiveness and a tendency to gall and smear; (2) high temperature at the tool point which may be a cause and result of the tool action; (3) an unusually low tool-chip contact area leading to high pressures at the tool tip; and (4) low thermal conductivity of titanium combined with the small contact area are contributing causes to the high tool-tip temperature.

Commercially pure titanium can be turned at 150 to 170 feet per minute with high-speed steel tools, 170 to 200 feet per minute with cast-alloy tools, and 300 to 320 feet per minute with carbide tools. High-strength titanium alloys, having a Brinell hardness from 275 to 350, can be turned at speeds between 30 and 60 feet per minute with high-speed steel, 50 and 80 with cast alloys, and 120 and 160 with carbides. Titanium alloys containing a high percentage of carbon may require much slower speeds. Feeds should be 0.004 to 0.007 inch per revolution with high-speed steel, 0.005 to 0.01 inch with cast alloys, and 0.008 to 0.015 inch with carbides.

Of the high-speed steels, the cobalt types are preferred for machining titanium. Cast-alloy tools are satisfactory, and the carbides that are recommended for machining all metals except carbon and alloy steels should be used. Rake angles from 6 degrees positive to 7 degrees negative are satisfactory with carbides; 5 degrees positive is successful with cast-alloy and high-speed steel tools.

The sharpness of the tool is particularly important. The presence of a wear land on the flank increases the tendency to chip welding and thereby accelerates tool wear. Cooling capacity is more important than lubricating qualities in the cutting fluid. Water-base soluble oils and chemical types are usually satisfactory. Rigidity of the set-up is important, as tool deflection might result in increased smearing on the flank.

Milling and Routing Titanium

Prevention of cutter chipping and breakage is the chief problem in milling titanium alloys. The short, individual chips characteristic in milling these materials do not fall off but remain welded to each tooth as it emerges from the cut. On the next revolution of the cutter, this chip has to be struck off. Often the bond is so strong that the tooth is chipped upon impact. The best solution is to place the work in such a way that the cutter teeth finish their cuts in a direction parallel with the feed. Maximum "bite" is thus taken at the start of the cut, and the welded-on section is only a sliver. In slab-milling, this means a climb cut. In face-milling, it means lining up the edge of the work with the emerging side of the cutter periphery, which is also climb cutting.

Either carbide or cast-alloy tools may be used for milling titanium. High-speed steel cutters do not give good tool life, and unless they can be resharpened and repaired readily, they are likely to prove uneconomical.

Relief is the most critical of the tool angles. Less than 10 degrees relief leads to excessive smearing along the flank; much more than 15 degrees weakens the tool and encourages chipping of the edge. Rake angles are not critical. Zero-degree axial and radial rake angles are satisfactory with Stellite; a zero-degree axial rake and as much as a 10-degree negative radial rake are about right for carbide.

Either a corner angle from 30 to 60 degrees or a large nose radius is advantageous, since either one gives a thin chip for a given feed and thereby minimizes chipping. It also utilizes a longer cutting edge at a given depth of cut, distributing the force over a greater area. This gives less unit pressure and helps dissipate the heat of cutting.

Heavy feeds appear to yield greater production volume per tool grind, but tool breakage is more frequent. A feed of 0.003 to 0.008 inch per tooth is about the logical compromise. Cutting speeds with carbide cutters can be as high as 100 feet per minute, and higher with lighter feeds. A speed of about 50 feet per minute is reasonable with cast-alloy tools.

Stacked sheets of Ti-100A or RC-130A titanium alloys, up to a total thickness of about 1/4 inch, can be routed with limited success. Titanium is so much harder and stronger than aluminum alloys that a direct substitution of routing methods can hardly be expected.

Slender, fragile routing cutters deflect so much when used on titanium that the customary thick stacks of sheets cannot be handled. Tool failure, as in milling, is hastened by the manner in which chips adhere to the tool. Relief angles must be

generous to minimize this tendency. Cutter deflection will change the tool geometry. Rapid wear by rubbing and galling on the tool flank is likely to precede actual tool breakage.

Drilling and Tapping Titanium Alloys

Chip flow, clogging, and point smearing are the major problems in drilling titanium alloys. It was found that drills should be supported as rigidly as possible. When stub type drills could not be obtained in the desired sizes, the longer drills were either broken off short and reground, or were encased in a snug-fitting sleeve, leaving only enough projection for the required depth of hole. Drill jigs should be used wherever possible.

The depth of hole drilled is an important factor in drill life. If deep holes—those having a depth greater than five diameters—must be drilled, the drill should be retracted at intervals to clear the hole and flutes of chips. At a depth-to-diameter ratio of 5 to 1 or greater, drill life may be reduced to 30 per cent of that obtained at depth-to-diameter ratios of 3 to 1, or less.

All the drills tested initially had 118-degree point angles, about 29-degree helix angles, and 9- to 11-degree clearance angles. This range of clearance angles was found best in drilling titanium alloys. Many of the drills were later reground to a point angle of 140 degrees. This blunt point was found superior only in the very small sizes. Later, a 90-degree point was also tried, and this proved advantageous for drills of 1/4-inch diameter or larger. Finally, a double-angle point was tried. In effect, this amounted to a blunt point (140 degrees) ground with the corners of the lips chamfered to an included angle of 90 degrees. From the limited testing that was done, this double angle seemed a decided improvement.

A feed range of 0.002 to 0.005 inch per revolution is suggested for drills smaller than 1/4 inch in diameter, and 0.005 to 0.009 inch per revolution for larger drills. It is important to use a continuous heavy feed.

Titanium alloys present a severe tapping problem. The largest diameter drill possible should be used in preparation for tapping. Spiral point, relieved taps having interrupted flutes are recommended. Slow tapping speeds are necessary, and highly active cutting fluids such as carbon tetrachloride should be used. Parts should be designed with the fewest possible threads.

Abrasive Cutting and Hacksawing

Bars of titanium alloy 3 inches in diameter can be cut off in about two and a half minutes using an oscillating head, wet type machine equipped with a 20-inch diameter cut-off wheel running at 7300 feet per minute. All the commercial titanium alloys except those containing a high percentage of carbon can be hacksawed with reasonable speed and efficiency. Cutting rates are 25 to 50 per cent slower than for quenched and tempered alloy steels of equivalent hardness. Blade life in terms of productivity is at least 50 per cent lower.

Average rate of hacksawing for stock from 2 to 3 1/2 inches square or round (having a Brinell hardness from 275 to 350) is 1 1/4 square inches per minute, with about 3 square inches per minute as maximum. This will yield a blade life of about 120 square inches cut, using 0.050 inch run-out as the limiting criterion. At a 5 1/2-inch stroke, the cutting speed should range between 45 and 75 strokes per minute. Feed per stroke should be 0.006 to 0.009 inch, depending on the titanium hardness and, to some extent, on the size of the piece.

The sawing machine should be a heavy-duty type, adequately powered, free of vibrations, and equipped with a positive feeding mechanism and coolant system. The work must be held securely and blade tension should be high. High-speed steel blades of coarse pitch, six to four teeth per inch, should be used. A sulphurized-chlorinated oil is satisfactory for general-purpose titanium sawing. Prior to sawing, casting or forging skins should be removed by pickling, snagging, sandblasting, or scarfing.

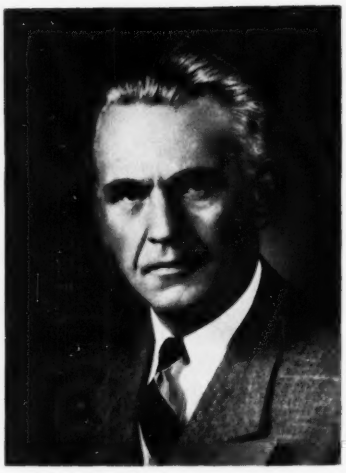
Grinding of Titanium Alloys

Silicon-carbide, 80-grit abrasive belts, operated at 1500 feet per minute with 100 pounds per square inch feed pressure, and a coolant, permit the removal of up to 4 inches of linear stock in fourteen minutes. In surface grinding, a table speed of 400 inches per minute, a cross-feed of 0.05 inch, and a down feed of about 0.001 inch should be used. Heavier down feeds may be employed for roughing, but for minimum wheel wear and close tolerance work very light down feeds are suggested.

A vitrified-bond, aluminum-oxide, 60-grit, M grade abrasive wheel has proved satisfactory for surface grinding with a wheel speed of 1500 feet per minute. Grinding fluids of the nitride-amine rust inhibitor type seem most suitable. If it is impossible to obtain the low wheel speed necessary for successful use of aluminum oxide wheels, silicon-carbide wheels can be used at conventional speeds.

Vol. 3, comprising the United States Air Force Machinability Report on titanium, can be obtained from the Curtiss-Wright Corporation, Wood-Ridge, N. J.

A Tool Engineer Looks at Europe



By William Bader, Vice-President
Research and Development Division
Wesson Co., Detroit, Mich.

THE American who is in Europe on business—renewing old connections, developing new ones—is the recipient of impressions not always in store for the tourist abroad. Coming into constant contact as he does with individuals in the Old World whose professional calling parallels his own, he can, from his vantage point, more readily appraise their efforts in overcoming the devastation left by World War II.

Leading technicians, particularly those in West Germany, realize the importance of simplifying and systematizing the industrial economy and the desirability of establishing complete accord between capital and labor—a philosophy the European embodies in the term "rationalization." The inextricable relationship between lowered production costs on the one hand and raised living standards and a greater share of the world's markets on the other hand, is permeating the thinking of many abroad, perhaps for the first time.

Basically, there are available too many competing brands of practically every item, so that the economies of quantity production accrue to none. In Germany, for example, there are over 400 types of radios. The automobile industry, embracing as it does scores of manufacturers, is reminiscent of the situation in this country thirty-five years ago. With American automobile production at present geared in some plants to a rate of 5000 to 10,000 units daily, the biggest manufacturers in Europe are counting production in so many hundreds of units.

On a trip to a typical German metal-working factory, the works manager is apt to show the visitor a photograph album. In it will be pictures of the building following a bombing attack. Other views may show various phases of reconstruction. A tour of the plant will disclose some very old equipment that has been salvaged. Here and there are found new machine tools of a very modern type, nearly always of domestic make. Some of these are original in design, some are imitations of American or other European machines. Production lines are beginning to be built around transfer and multiple-spindle type machines. There is a definite trend toward unit construction of machine tool elements, with less emphasis being placed on exterior finishes. Tracer lathes are rapidly increasing in popularity.

In the cutting tool industry, the writer found cemented carbide manufacturers and fabricators of tipped tools to be well organized, efficient, and progressive. Conventional cutting tool materials are being replaced by carbides wherever conditions are favorable—in metal-working industries, as well as in woodworking, mining, and ceramic industries. Brazed tipped tools are still more widely used than tools with mechanically clamped tips or the indexing insert style tools. The last mentioned, however, are finding increasing acceptance for application as single-point tools and milling cutters in automobile plants.

Some of the leading cemented carbide manufacturers offer as high as twelve different standard grades and, in addition, a number of special grades for certain specific applications for machining metallic and non-metallic materials. Special grades for woodworking tools are classified as such. Other grades have been developed for different purposes, like nibs for wire-drawing and extrusion dies. Clearance angles for carbides deviate very little from American practice. However, in regard to rake angles, the tendency is more to positive than to negative design. Research work in this field is very much advanced in West Germany.

As in this country, the extensive use of cemented carbide tools in Europe has created a demand for greater rigidity in machine design, higher spindle speeds, and more flexibility in

speed and feed ranges. To enable unskilled and semi-skilled workers to operate these machines, automatic controls are more and more in evidence, particularly of the electric and electronic types. Automatic sizing and inspection instruments, optical comparators, and optical measuring equipment are helping to improve quality and increase production.

Enlightened companies are adding to their manufacturing facilities customer service departments, technical advisory staffs, and apprentice training programs. This approach is a sound and optimistic one, and shows confidence for the future, so badly needed in these times.

* * *

Book on Quality Control

QUALITY CONTROL—Second Edition. By Norbert L. Enrick. 181 pages, 6 by 9 inches. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y. Price $4.

In this enlarged second edition, some sixty pages of new text, tables, and charts have been added to provide a more complete and useful discussion of quality control in its various aspects. Among the new subjects considered are the coefficient of variation, a yardstick of variability which is often useful, especially in the processing industries; how to test a distribution for normality; how and when to use control charts computed from center lines; the application of multiple control charts to control several individual components of a product at one time; the use of acceptance control charts for accepting or rejecting a product received from an outside supplier; the interpretation of frequency distribution curves; where to use control charts for per cent defective product; and the analysis of variations between machines and departments as an aid in locating sources of product difficulty.

As in the first edition, a simple, direct approach to each subject is used and both highly technical language and complicated mathematical formulas are avoided. The emphasis is placed on the practical application of quality control and an understanding of the basic methods. As such, this book makes an excellent introductory text for both the student—who although not planning to specialize in quality control needs an understanding of it—and for the practical man who wants to be able to improve the quality of his product and to reduce scrap and spoilage.

All the essential techniques of modern quality control are covered, such as sampling plans, control charts, analysis of variations, statistical determination of tolerances, as well as administrative procedures and controls.

How Functional Specifications Affect Gaging Requirements

(*Continued from page 191*)

motion is read on a dial indicator gage, or it may be recorded on a paper tape. When this action is recorded on a tape, different types of errors show somewhat different characteristic changes in the shape of the recorded graph. These can be evaluated to some degree, and a reasonably definite specification for the results of such a test can be included on the detail drawing.

All in all, the present state of the art for the specification and testing of the required functional conditions of gears leaves much room for improvement. The few facilities now available are adapted to the testing of a very limited range of sizes. Adequate functional testing equipment for the very small instrument gears of fine pitch, and also for the larger gears used in many power drives, is non-existent. In these cases, the functional testing of the assembled components must wait until the unit is assembled.

Balancing Tests—Another physical condition of the components, or of some assembled groups or unit assemblies, which can only be tested by functional means is that of the static and dynamic unbalance of units which must rotate at relatively high or very high speeds. Balancing machines of many sizes and types are available for most of these situations. When the rate of production is high, special balancing machines, together with built-in means for removing metal to correct the balance, are often designed and constructed. The specification for the control of this condition of balance usually consists of notes on the detail drawing which give the maximum amount of static and dynamic unbalance that can be permitted on either the component or the assembled unit.

In certain cases, such as those of the connecting-rods and pistons of internal combustion engines which must be of equal weights within close limits for any given engine assembly, these parts are sorted and segregated by weight, and sometimes by the size of the mating features as well. This introduces a degree of selective assembly in the manufacture of these parts. The crankshafts themselves are balanced to the prescribed limits. Mating parts of equal weights are selected to assemble with each individual crankshaft before it is assembled. In such cases, the information about the weight limitations for each selected group will appear on the detail drawing as a part of the dimensional or physical specifications. The weighing and the sorting of these components can be classed as another functional test.

Machine Tool Electrification Forum Concentrates on Automation Problems

A CHALLENGING theme—"Engineering for Tomorrow"—was the keynote of the eighteenth annual Machine Tool Electrification Forum of the Westinghouse Electric Corporation held at the Hotel Statler, Buffalo, N. Y., on April 6 and 7. The Forum attracted a record attendance of 450 electrical engineers, machine tool builders, and editors from the technical press. Significantly, key personnel from several automobile plants took a prominent part in the proceedings, presenting the problems of machine tool electrification from the standpoint of the user of highly automated equipment.

In the morning sessions, a group of interesting and authoritative papers was presented dealing with the general subjects of new methods of machining metals and instrumentation as a production tool. Panel discussions in the two afternoon sessions considered the role of machine tools in the automobile industry and the new electrical standards recently promulgated by the Electrical Committee of the National Machine Tool Builders' Association.

Papers Explain New Machining Methods

C. Paul Porterfield, Method X Co., described the various types of electromachining, elaborating on the spark-initiated discharge type under development by his company for machining extremely hard metals. In this technique, the tool, usually brass, serves as an electrode that bombards the work surface with controlled spark discharges, dislodging particles of metal that are then floated away by a dielectric fluid. The profile of the cut is determined by the electrode shape.

The nature, present status, and future of electrolytically assisted grinding were described in a paper by George Comstock of the Norton Co. This technique combines an electrochemical decomposition of the work material simultaneously with conventional grinding procedure. Essentially, the operation is a reversal of electroplating.

The design and industrial applications of magnetic amplifiers were considered by C. G. Helmick, of Westinghouse. Citing the inherent reliability, simplicity, and ruggedness of these amplifiers, the speaker predicted a popular use for them in the field of machine-tool control.

Dr. R. L. Bright, also of Westinghouse, reviewed the status of transistors, and suggested some possible applications to machine tools. Dr. Bright cautioned his listeners to correct the currently popular misconception that the transistor will completely replace the vacuum tube. A simplified servo system for turret positioning on a punch press manufactured by his company was the subject of an interesting paper by Walton Rainey of the Wiedemann Machine Co.

Instruments as Tools of Production

A device known as an "Atcotran" is the heart of a system developed by the Avey Drilling Co. for automatically gaging work drilling positions, according to Harlan E. Grimes of that company. Utilizing the output of a differential transformer, the system is also able to measure the amount of deviation. Success in applying automation to smaller machines was described in the paper, "Otto, the Automaton," presented by E. L. Behringer, Micromatic Hone Corporation. "Otto," a machine for honing the inside diameter of gear blanks, features automatic preloading, positioning, clamping, measuring, and unloading.

A panel devoted to machine tools in the automobile industry gave its recommendations on the nature of control equipment. G. P. Krieg, Packard Motor Car Co., believed that the machine tool builders should supply a package unit that also includes the devices for loading, positioning, unloading, and gaging. W. B. Shimer, DeSoto Division, Chrysler Corporation, expressed the preference of his plant for straight-line transfer type machines over rotary indexing machines in instances where automation was to be applied. R. W. Kowitz, Ford Motor Co., contended that the success or failure of a high-priced transfer type machine is often determined by the proper application and reliability of relatively inexpensive limit switches, relays, and timers.

The Forum's guest luncheon speaker, Herbert L. Tigges, executive vice-president, Baker Bros., Inc., and president of the National Machine Tool Builders' Association, contended, "It is up to American industry to prove that more people can get more of the things they want under our free competitive system than they can under the communist system, the socialist system, or any other system yet devised by mankind. But to make this proof, American industry must each year be able to provide the average American citizen with more of the things he wants in return for his day's work. This brings us to cost reduction, increased productivity, and new and improved machine tools."

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Lathe Fixture for Machining In-Line Bores

By RALPH T. STEWART, Winston-Salem, N. C.

Maintaining center-line accuracy between two in-line bores for anti-friction bearings without the costly machining of locating surfaces has always been a problem. Such an operation may be performed quickly and precisely with the indexing type of fixture illustrated. This device was used originally in machining ball-bearing housings for mounting sawmill mandrels.

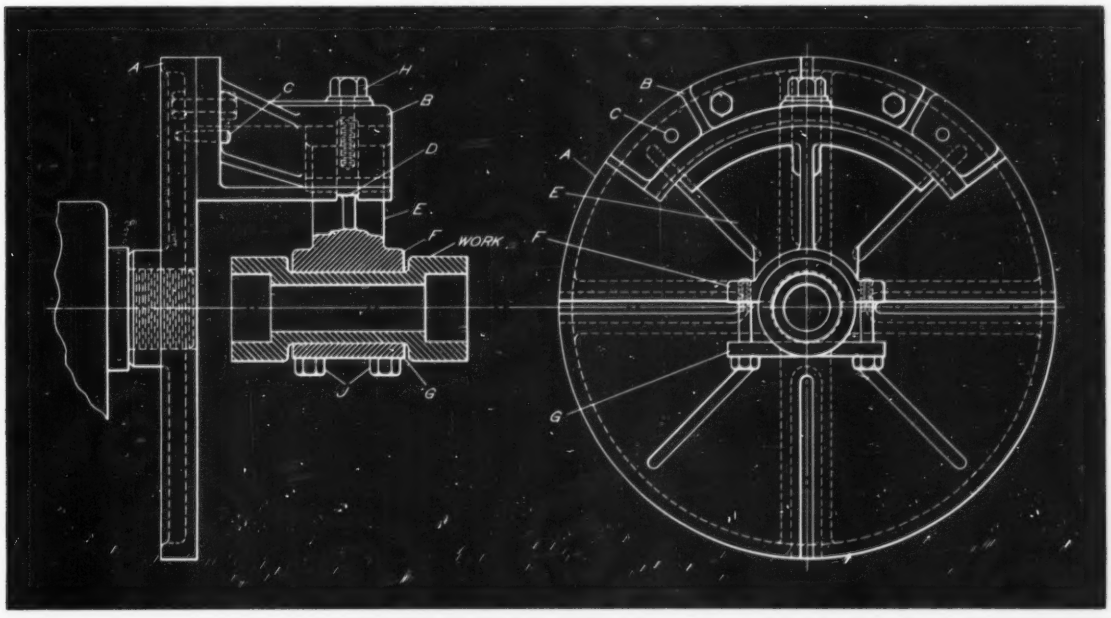
Faceplate *A* is the basic component of the fixture. Bolted to it is a ribbed cast bracket *B*, which is located positively by two taper pins *C*. The bracket is first machined on its mounting face adjacent to the faceplate. After bolting and pinning, the assembly is mounted on a lathe and the curved portion of the bracket, including a groove *D*, is machined.

A second cast bracket *E* has sides that taper from a wide, arc-shaped top to a clamping boss on its lower extremity. A tongue is machined along the arc to an accurate fit with its mating concave groove in bracket *B*. This is done by placing a stud between clamping jaws *F* and *G*, and holding it in a chuck.

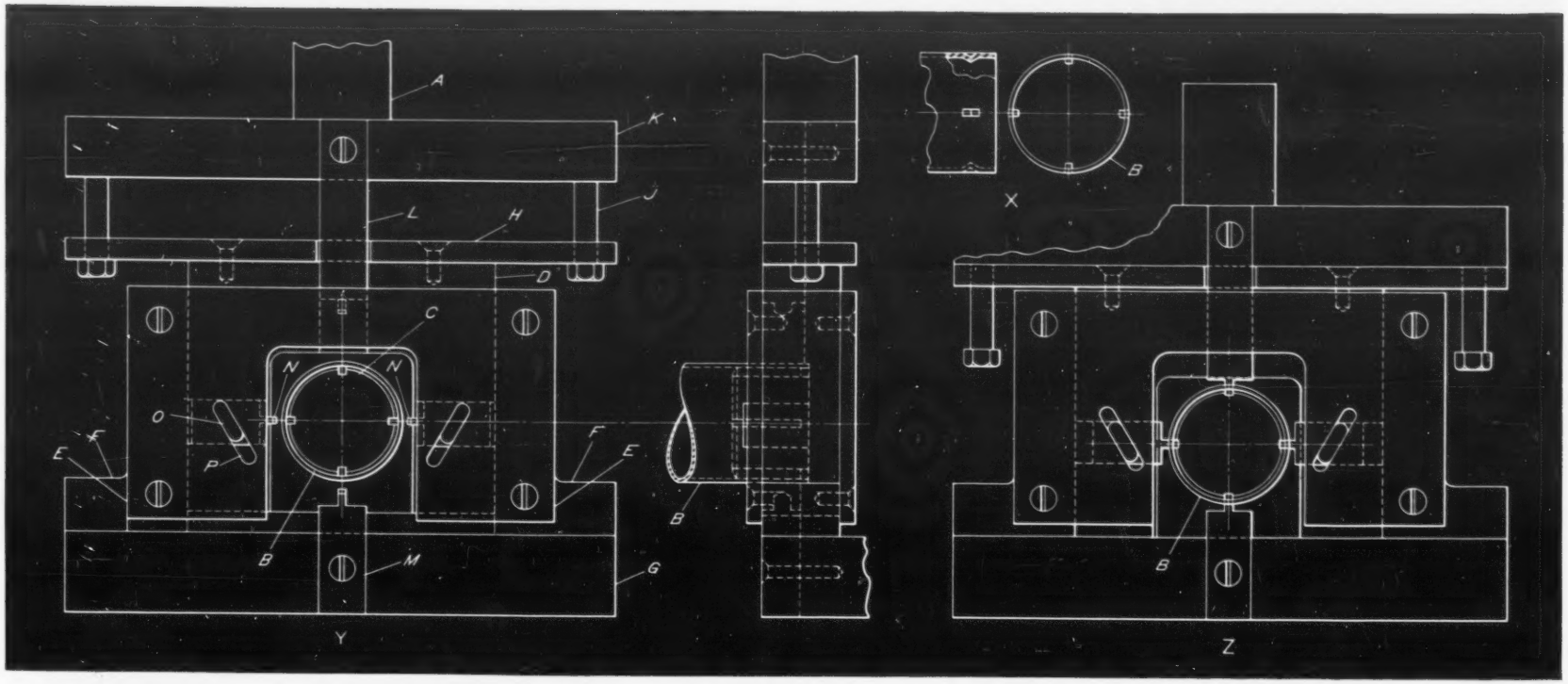
Screw *H* passes through bracket *B* and is threaded into bracket *E*, thereby locking it in position. When this is done, a truing cut is taken on the internal clamping face of jaw *F* to bring the jaw to the diameter of the work-piece it is intended to hold.

In operation, the fixture is secured to the headstock spindle of a lathe. The work-piece is placed between clamping jaws *F* and *G*, and is held firmly in place by tightening four bolts *J*. In this manner, one bearing seat may be bored out and the end faced.

To bring the work-piece into position for line-boring the opposite end, screw *H* is loosened and bracket *E* rotated 180 degrees. Upon tightening the screw, the bracket will be drawn up snugly into the groove in bracket *B*, and the part will be centered with respect to the first bearing bore. It may be necessary to use counterweights for high-speed operation.



Lathe fixture with swiveling work-holder for boring in-line bearing seats



The cam action of the ribs (O) in the angular slots (P) causes the side punches to move toward the tubing on the down stroke of the press ram.

Die Punches Four Notches at One Time

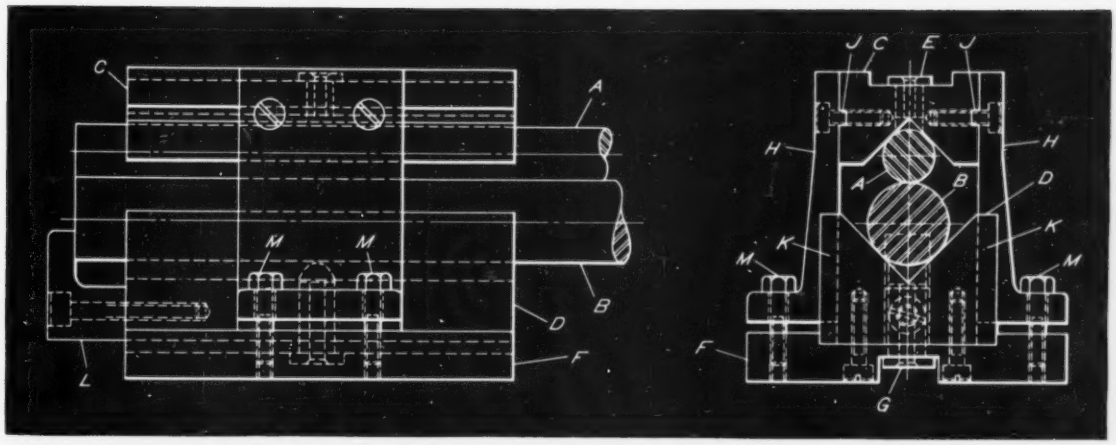
By L. KASPER, Philadelphia, Pa.

Resourceful die design has made it possible to produce four equally spaced indentations around the periphery of tubing in a single press stroke. The arrangement of the indentations in the work can be seen at X in the drawing.

End and elevation views of the die are shown at Y, the press ram *A* being at the top of its stroke. The tubing *B* is slipped over a horn *C* having slots in the areas where the indentations are to be made. This horn is fixed to a block *D*, which is the principal element of the die. Keeper plates *E* retain the block in alignment. The block is free to move vertically between the end-pieces *F* of the base *G* of the die. Fastened to the top of the block is a cross-piece *H*, suspended by bolts *J* from the punch-holder *K*.

An upper punch *L* is attached to the punch-holder, and a lower punch *M* is fixed in the base. The two side punches *N* slide horizontally in a channel cut across block *D*. A rib *O* on the front of each side punch is a close fit in an angular slot *P* in its respective keeper plate. Since the keeper plates are stationary, vertical movement of the block produces a horizontal movement of the side punches.

On the down stroke of the ram, the block is free to descend behind the keeper plates, causing the side punches to move toward the tubing. When these punches abut the outside of the



Fixture with adjustable V-blocks for centralizing two shafts of different diameters for cross-drilling operations

tubing, the movement of the block is arrested and the ram continues its descent independently until the punch-holder contacts the cross-piece. The ram and block then continue down as a unit, the side punches starting to indent the tubing. Shortly thereafter, the upper and lower punches come into contact with the tubing and start their indentations.

When the ram has reached the bottom of its stroke, as seen at Z, the block has descended until it bears on the base, and all indentations have been completed. Since the velocity of the side punches is lower than that of the ram, the side punches start to operate earlier so that all indentations are completed simultaneously.

Cross-Drilling Two Shafts in One Set-Up

By W. M. HALLIDAY, Birkdale, Southport, England

Drilling in-line holes through two cylindrical shafts requires a considerable amount of care, especially if the shafts are of different diameters. The device here shown was used for this type of operation on bars ranging from 1/2 inch to 1 1/2 inches in diameter.

Referring to the illustration, shaft *A*, 5/8 inch in diameter, had to be drilled 0.125 inch diametrically, and shaft *B*, 1.0 inch in diameter, had to be drilled in-line to a diameter of 0.218 inch. The jig consists of two casehardened and ground V-blocks *C* and *D*, having 90-degree V-slots across one face. A drill bushing *E* is pressed into the upper V-block. Baseplate *F* is machined to receive the lower V-block *D*, which is secured by cap-screws. Bushing *G*, pressed through the baseplate and into the V-block, provides for drilling the hole accurately in the larger shaft.

The V-blocks are aligned by means of two casehardened and ground L-shaped steel brackets *H*. Ground tongues *J* on the inner faces of the brackets fit tightly into machined grooves on the sides of the upper block. Two cap-screws on each side secure the V-block between the vertical inner sides of the brackets. The sides of the larger block are slotted vertically at *K* to a sliding fit with the brackets. With the blocks and brackets connected in this way, correct alignment will be maintained.

To load the jig, the larger diameter shaft is placed in the vee of the lower stationary block and banked against a stop-bracket *L*. The smaller shaft is then placed in the jig with its end aligned with the end of the larger. Tightening the four clamping screws *M* equally will draw the upper V-block down evenly toward the stationary block. Both rods are tightly gripped and automatically centralized in correct axial alignment with each other.

In drilling the respective holes, the jig is first placed on the machine-table with the baseplate down so that the hole may be drilled in the small shaft. Then the jig is inverted for drilling the hole in the large shaft.

* * *

Sound Film on Taps Available

The Threadwell Tap & Die Co. has produced a fifteen-minute sound slide film entitled "Taps and Tap Terms" which is available for group showing. The film contains no advertising but is designed to explain the types of taps and their nomenclature. This information should be of interest to users of taps. Arrangements for group showings of this film can be made by writing to the Threadwell Tap & Die Co., Greenfield, Mass.

The Sales Engineer and His Problems

By BERNARD LESTER
Management Consulting Engineer
New York

Getting Rid of Cows that Don't Pay

AN expert manager of a successful dairy farm has a dynamic replacement plan. He repeatedly makes a complete inventory of his herd, considering the age, condition, and productivity of each cow. He replaces every animal that doesn't pay a profit before it eats its head off.

Machine tools are not cows, an industrial plant is not a farm, and the problem of replacing production tools is far more complex than that of replacing cows in a dairy herd. But if a policy of replacement is essential to the profitable operation of a dairy farm, it is just as or even more essential to an industrial enterprise.

A properly informed sales engineer can in many cases aid in reaching a practical solution of replacement problems. Besides selling the prospect on the desirability of adopting a policy of replacement, the sales engineer can contribute to a plan without becoming involved in intricate accounting practice. By understanding the fundamentals of replacement, the sales engineer has in his hands a valuable sales tool, whose use can extend far beyond the immediate sale. This sales tool has a double edge. One edge can cut out losses for the prospect. The other can carve out future inquiries for the sales engineer.

Let us refresh our minds on the fundamentals applying to replacement. First of all, buying new machines is an investment. Possessing and using them are an expense. In calculating the efficiency of installed machines and tools, all costs must be considered—man-hours, materials, set-up time, losses from defective work, repairs, and all overhead charges.

To conduct a successful farm or plant, funds must be set aside for capital shrinkage. Sensible machinery users depreciate equipment as fast as the law allows. The rough-and-ready way to do this is to deduct the estimated disposal price of the machine from the original price, and divide the remainder into equal parts based on the calculated life of the machine to determine the annual depreciation. However, there are many machines in use today which actually could be profitably replaced in spite of an extended allowable rate of depreciation.

With depreciation fundamentals in mind, why not consider what each of us can do to get the prospect to adopt a dynamic replacement plan? Three specific suggestions may help turn the trick with plant owners and managers: (1) Assign to one man the job of analyzing machinery replacement; (2) make an inventory of all factory equipment; and (3) become thoroughly informed about the new and improved equipment that is available.

There is one question that could well be asked of plant managers—"Is the man responsible for equipment replacement good at accounting as well as fully informed on modern plant equipment?" Both kinds of knowledge are required in a man responsible for production equipment, who should be sparked by a ferret's eye for increased profits.

An efficient plant manager would not carry in stock perishable or worthless materials that would accumulate a loss. Production equipment is worth more than material stock and therefore should be appraised periodically. It is safe to say that industry suffers a greater loss from equipment inefficiency than from the depreciation of raw and finished products.

Many plant managers inherit the "expense approach" in regard to new equipment rather than the "investment approach." In spite of an active technical press constantly drawing attention to improved equipment and processes, there is a singular lack of initiative on the part of plant management to accept today's opportunities toward greater efficiency. Herein lies the open door for equipment salesmen.

Fifteenth Edition of MACHINERY'S HANDBOOK

MACHINERY'S HANDBOOK, Fifteenth Edition. 1911 pages, 4 1/2 by 7 inches. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y. Price, $9; add 92 cents for postage to Canada and overseas.

Over 1,000,000 copies of MACHINERY'S HANDBOOK have been printed in fourteen editions since it first appeared in 1914. The new fifteenth edition, now ready for use, makes available the recent and basic information, data, and formulas that the handbook user in the mechanical field needs to keep abreast of current developments.

The rapid growth and accumulation of data in the technical field, the large number of new standards, the changes in engineering and manufacturing practice, and the advances in new materials and alloys all place a heavy demand for space on present-day handbooks. As a result, the word "handbook" in its original sense has almost become a thing of the past, so few are the reference works that still retain the physical character of a handbook.

MACHINERY'S HANDBOOK, however, remains in its size and format the same as its predecessors—compact, handy, and easy to use. This objective of keeping it a handbook in the true sense of the word has been achieved only by a policy of careful, painstaking editing to achieve compactness and yet arrange the new material so that it is in as clear a form as possible—whether text, formula, or table. As in previous editions, great care has been used to select new matter which will be of the most value to designers and builders in the mechanical field.

Of particular interest in the fifteenth edition are a revised and rearranged spur gear section and an entirely new section on generated bevel gears. Featured in the spur gear section is a greatly enlarged presentation of standard definitions and terms; formulas and tabulated data for readily determining the dedendums and root diameters for hobbing and shaping pre-shaved gears; full data and information on fine-pitch spur gears, including tolerances for gear blanks, and data for enlarged pinions; and recommendations and tabulated data for obtaining the proper amount of backlash in various types of gears.

In the bevel gear section, the various types of bevel gears and their applications are described. A detailed presentation of the revised Gleason system of straight and bevel gears is included with formulas, charts, and step-by-step procedures for designing bevel gears for durability and strength. In addition, there are formulas and methods for determining thrust and radial loads, and a table of recommended bevel gear materials.

A new section on fine-pitch worms and wormgears has been added in which the step-by-step design procedure is outlined and formulas are given for obtaining profile and pressure angle corrections for cutters and grinding wheels used to produce fine-pitch worms.

Important changes in the dimensions of American Standard square and hexagon bolts and nuts are summarized, with a table comparing the old and new across-flats dimensions. Complete tables giving the standard sizes and limiting dimensions of the various types of nuts and bolts are also included.

Thread classes, thread form, allowances, tolerances, limiting dimensions, and preferred thread series of the American Standard General-purpose Acme and Stub Acme screw threads are given in the extensive and detailed screw thread section.

The section on ball, roller, and needle bearings is completely new and gives in considerable detail and scope the descriptions, designations, ranges of standard sizes, boundary dimensions, and tolerances for standard anti-friction bearings. Also outlined is the Anti-Friction Bearing Manufacturers Association plan for bearing designation. Standard minimum shaft shoulder and maximum housing shoulder dimensions for ball and cylindrical roller bearings are also given.

The new milling cutter section now gives extensive tables of dimensions and tolerances covering the various types of American Standard milling cutters, together with a table showing four types of set-ups for grinding clearance angles on milling cutter teeth.

Standard dimensions of tool shanks, toolpost openings, lathe center heights, types of standard toolposts, lengths of solid square and rectangular tools, and dimensions and commercial catalogue numbers of sintered-carbide tips for single-point tools are now an important part of the small cutting tools section.

Additions to the section on honing include formulas and data for determining the proper rotative speeds, recommended tolerances, allowances for stock removal, and possible adjustments for eliminating undesirable conditions. In the materials section, new data on nickel and nickel alloys, titanium and titanium alloys, and copper-silicon and beryllium alloys are presented.

These highlights can only indicate some of the more important features of the new and revised material which has been incorporated into MACHINERY'S HANDBOOK as it appears in its fifteenth edition.

LATEST DEVELOPMENTS IN *Shop*

Warner & Swasey Heavy-Duty Turret Lathe

A 3A heavy-duty saddle type turret lathe, the first of four new models to come off the assembly line, has just been announced by the Warner & Swasey Co., Cleveland, Ohio. Greatly increased power is provided to permit taking advantage of any future improvements in tooling, cutter design, and cutter materials. More speeds, varied by smaller increments, enable a greater range of work diameters to be machined at the most effective cutting speeds. Automatic, hydraulic gear shifting reduces handling time and operator fatigue. This machine, designated M-3500, handles round bars 4 1/2 or 6 inches in diameter. The effective swing of the lathe is 23 1/2 inches.

An important feature of the new headstock is a sixteen-speed hydraulic shift pre-selector head. Four speeds have been added to give a range of 35 1/2 to 1, as compared to 26 to 1 on the earlier twelve-speed machine. With a two-speed motor, thirty-two unduplicated speeds can be pre-selected, ranging from 12 to 851 R.P.M. Available maximum horsepower has been increased 50 per cent and the top speed 35 per cent.

The headstock has disc type hydraulic clutches for forward, reverse, and brake action, with reverse speeds exactly equal to the forward speeds. The master control lever *A* as seen in Fig. 3, has four positions: forward, neutral, brake, and reverse. Shifting of gears is done hydraulically and automatically in a matter of seconds by four hydraulic cylinders in the headstock, which can be seen in Fig. 2.

In gear shifting, the setting is first made for the proper speed, in surface feet per minute, by means of the pre-selector knob, or handwheel, *B*, Figs. 2 and 3, drum *C* indicating both surface feet per minute and revolutions per min-

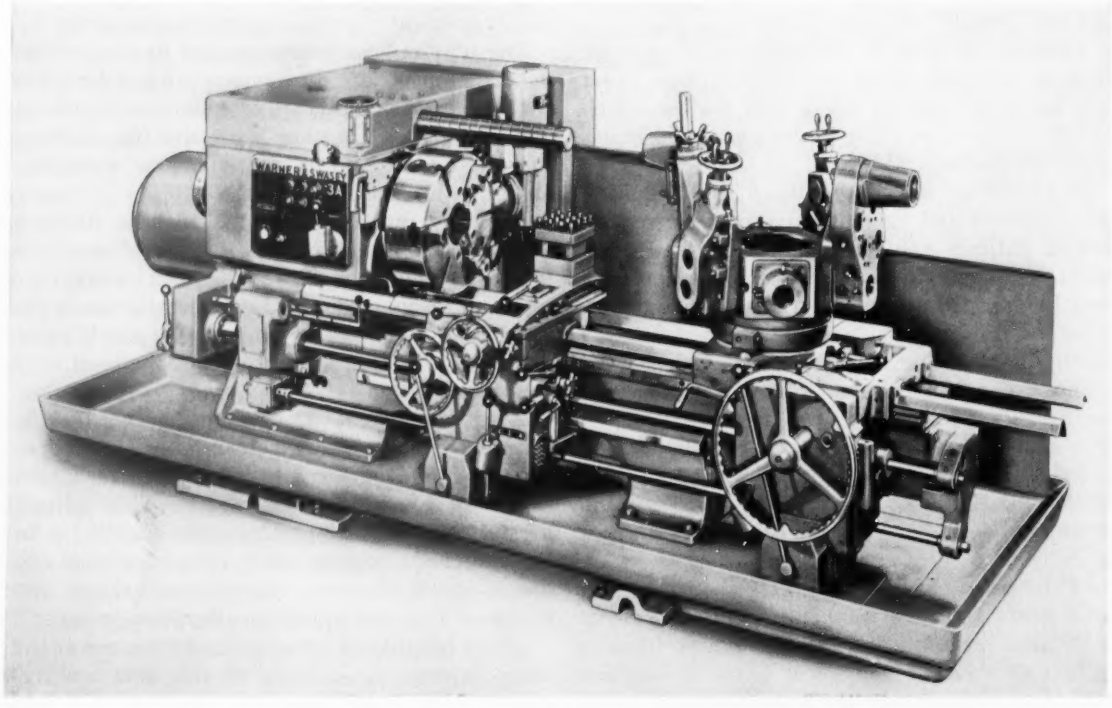


Fig. 1. Warner & Swasey heavy-duty saddle type turret lathe equipped with automatic hydraulic gear shifting mechanism designed to reduce handling time and operator fatigue

For more information on these products, use Inquiry Card, page 247

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

ute; and then the master control lever *A* is pushed in toward the headstock. The following sequence of operations takes place automatically within the headstock: the gear train immediately slows to a "crawl" speed by the braking action of the crawl clutch; the hydraulic pressure is directed to the proper shifting cylinders, Fig. 2, as determined by the preselector valve which was actually set by the operator when he selected his new speed; shifting of the gears is accomplished hydraulically; and finally upon completion of the gear shifting, the master control lever is automatically snapped "out" to the normal run position so that the spindle again revolves at the new preselected speed.

In addition to the knob and dial, the control panel (Fig. 3) contains high-low motor start-buttons, a motor stop-button, a chuck wrench, an "external-internal" selector switch, a headstock oil-pressure gage, and a spindle-inching button that provides micro movement of the spindle for chuck and fixture positioning. A lever to the right of the panel controls the functions of the power chuck wrench.

The cross-slide and hexagon turret are equipped with rapid traverse units of a new design, requiring less operator effort and being easier to adjust and maintain. The power rapid traverse on the cross-slide provides both longitudinal and transverse movements.

Head end gear-boxes incorporate anti-friction bearings with automatic oil supply. The pans accommodate the larger sumps required and provide more chip capacity. The new beds, saddles, carriages, and aprons are designed to provide the rigidity, strength, and accuracy necessary to meet the requirements of the increase in horsepower and speeds. The hexagon turret locating and clamping mechanism also provides a more powerful toggle action and greater holding power for the hexagon turret clamp. 101

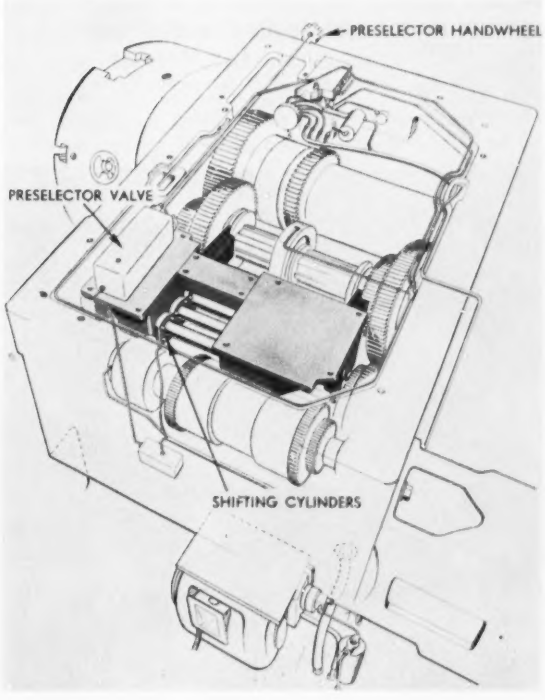


Fig. 2. Gear-shifting cylinders and pre-selector valve in headstock of lathe seen in Fig. 1

Fig. 3. Control panel of the Warner & Swasey heavy-duty saddle type turret lathe

For more information on these products, use Inquiry Card, page 247

Fig. 1. DoAll precision surface grinder adaptable to production operations

DoAll Large-Size Precision Surface Grinders with Automatic Features

Down feed, "skip" feed, and reverse cross-feed are among the operations that can be automatically controlled on the versatile Model D10 precision surface grinder introduced by the DoAll Co., Des Plaines, Ill. This large-size hydraulic surface grinder, shown in Fig. 1, has a working table area or chuck surface 10 by 30 inches. The machine can be readily modified (at the factory) for automatic flat or crush-form contour-grinding operations, making possible the mass production of precision parts comparable to parts made in the tool-room.

With regard to form grinding (manual or automatic), the large work capacity of the new model permits the crush roll dresser (Fig. 2), or other kind of form dresser, to be positioned permanently at the end of the work-table so that adequate space remains for the work. In ordinary form grinding, and particularly in production form grinding operations where frequent wheel dressing is required, time is thus saved—since the initial dressing set-up remains on the grinder.

In many cases, a large number of pieces can be held in a fixture and ground simultaneously. Comparatively little skill is required on the part of the operator other than familiarity with the functioning of the machine controls. The machine can also be arranged for automatic surface grinding where the object is to produce a flat surface that is accurate in thickness to a predetermined dimension. The automatic features of the grinder can be quickly disengaged, permitting manual control and operation as a conventional hydraulic surface grinder. 102

Sinclair Quenching Oils

A new series of quenching oils, designed to produce better metal products more economically, has been developed by the Sinclair Refining Co., New York City. These oils, called the Sinclair Quenchol 500 Series, are said to embody a new concept in metal cooling. They offer greatly increased cooling power to assure a higher, more uniform degree of metal hardness as well as greater depth of hardness.

Performance tests indicate that the oils will produce a substantial reduction of piece rejection rates and will enable metal-working plants to utilize lower cost steels for critical purposes. Other features of the Quenchol 500 Series are minimum oil evaporation and drag-off, together with prolonged service life due to high resistance to deterioration and breakdown. 103

Multiple-Crank Progressive Die Presses

A complete line of multiple-crank progressive die presses has been brought out by the Brandes Press Co., Dept. M, 6408 Euclid

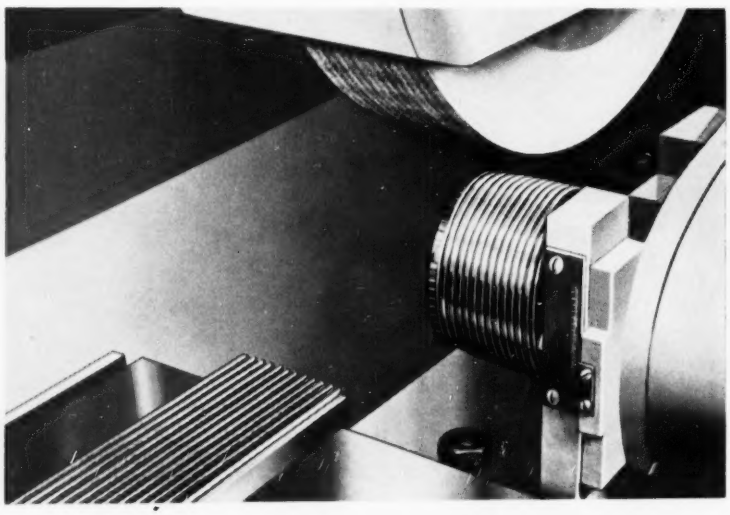
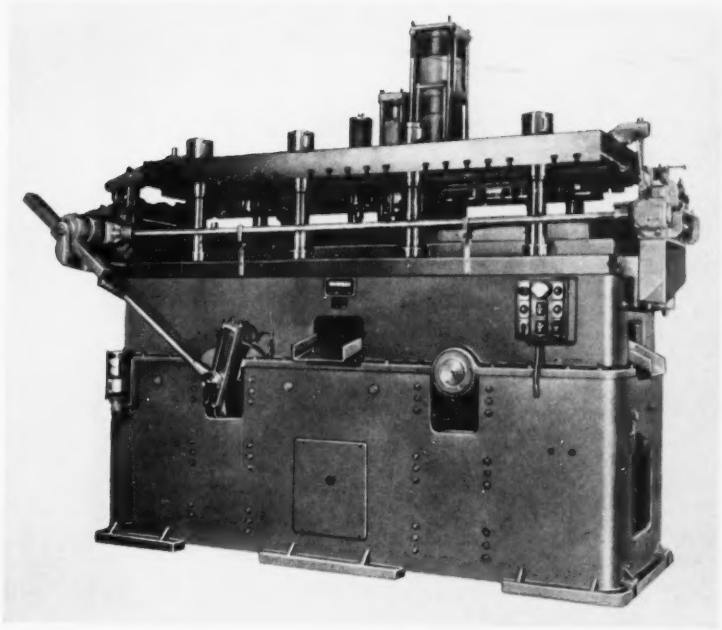


Fig. 2. Crush roll dresser mounted at end of work-table of DoAll grinder

For more information on these products, use Inquiry Card, page 247



Brandes 300-ton double-crank progressive die press

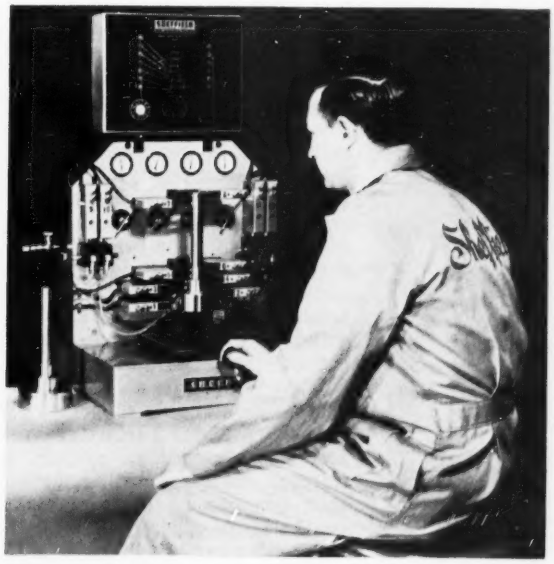
Ave., Cleveland 3, Ohio. The cranks are synchronized and the presses designed to add any number of double-crank combinations. An even pressure is maintained on all stations, and the top platen is always parallel with the bed so that there is no tipping under load. Presses range in size from 100 tons—for a die length of approximately 8 feet—to 4000 tons for a die 20 feet long. 104

Sheffield Gage Inspects Thirteen Dimensions

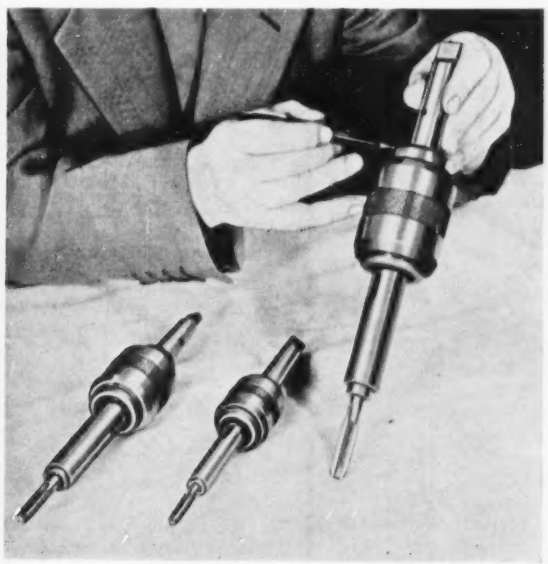
A gage that inspects thirteen dimensions simultaneously on a rear planetary carrier assembly has been produced by the Sheffield Corporation, Dept. M, Dayton 1, Ohio. It indicates by means of colored electric lights whether the dimensions are within tolerance or are over or under size. Parts can be inspected on this "Multichek" at the rate of 600 to 800 per hour at 100 per cent efficiency. The instrument is set up with maximum and minimum masters. When all dimensions are within tolerance, a master light shows white and the thirteen signal lights black out. However, if one or more dimensions are out of tolerance, the master light shows red, and the signal lights indicate the faulty dimensions by showing red for under size or green for over size. Lights of all the correct dimensions black out. 105

Scully-Jones Driver Eliminates Tap Breakage

A tap driver with adjustable torque and a releasing roller drive is available from Scully-Jones & Co., Chicago 8, Ill. A substantial decrease in tap breakage, as well as improved accuracy and finish, has been attributed to the driver. The device consists of a drive shell, two rollers, and an inner drive collet. Torque is transmitted when the rollers are wedged between the drive shell and cams on the drive collet. When the torque exceeds a pre-set limit, the drive shell expands, permitting the rollers to enter a cylindrical portion and release the drive. As long as the machine spindle continues to rotate, the driver revolves in the released position on ball bearings.



Sheffield "Multichek" for rear planetary carrier assembly



Scully-Jones tap driver with adjustable torque

For more information on these products, use Inquiry Card, page 247

Fig. 1. "Big 60" knife and shear blade grinder built by the Hanchett Mfg. Co.

The driver can operate at maximum speeds when bottoming. A spring-loaded centering plug behind the collet absorbs shock when a tap strikes the bottom. Three sizes of drivers are being produced, for No. 8 (32 threads per inch) to 1/4 inch, 5/16 to 7/16 inch, and 1/2 to 5/8 inch tapping ranges. Torque is adjustable from 55 to 660 inch-pounds. 106

Hanchett Blade and Knife Grinding Machines

The Hanchett Mfg. Co., Dept. M, Big Rapids, Mich., has announced the development of a new machine for grinding the bevels of all types of straight knives and shear blades, including chipper and hog knives, as well as all types of heavy-duty shear blades. This "Big Hogger" machine, shown in Fig. 1, is designed to take extremely heavy cuts at a high rate of table travel. Provision is made for using a large volume of coolant on the work, permitting knives and shear blades to be ground without burning.

The machine is equipped with a segmental grinding wheel 60 inches in diameter and a 30- to 100-H.P. motor which drives the spindle through sheaves and six V-belts.

Hanchett has also developed a new grinder for top and bottom slitter knives and all types of circular knives. This SK-24 grinder, Fig. 2, permits grinding the knives to close precision tolerances both for concentricity and micro-inch finish. The machine supplies ample coolant directly at the point of wheel contact to prevent burning the knives during grinding and to obtain the best possible finish. Automatic oscillation of the grinding wheel serves to insure accuracy and fine finishes.

Slitter knives are held in a horizontal plane, rigidly supported by a backing plate. The fixture revolves mechanically, giving a smooth, uniform cutting action that develops no chatter marks on the knife edge. Positive positioning for any bevel from 0 to 90 degrees is obtained by adjusting a graduated dial. An easily ad-

Fig. 2. Hanchett grinder for top and bottom slitter knives and circular knives

For more information on these products, use Inquiry Card, page 247

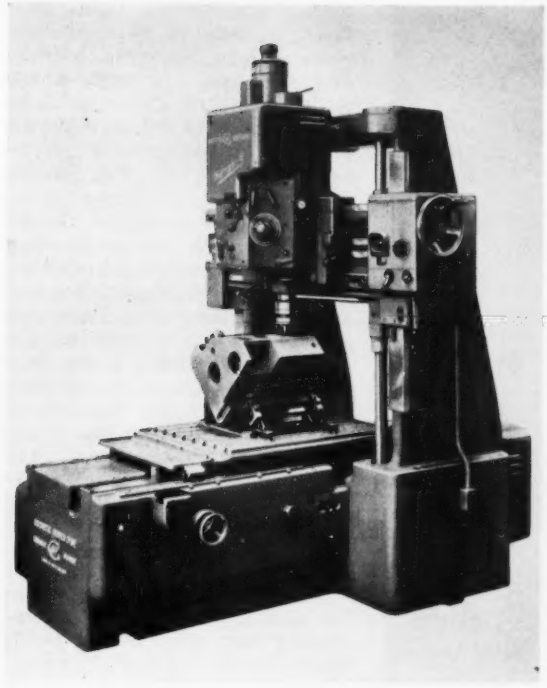


Fig. 1. Hydroptic-6 jig borer recently introduced in this country by the American Sip Corporation

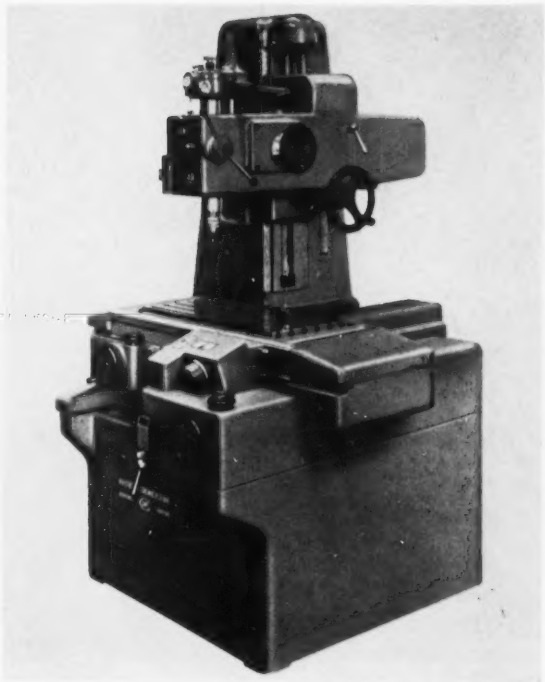


Fig. 2. Small single-column jig borer exhibited at the recent A.S.T.E. Show by American Sip Corporation

justed stainless-steel diamond wheel dresser holder is mounted below the work-fixture. 107

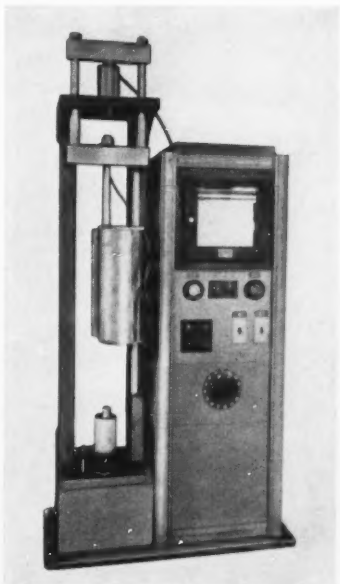
Relaxation Creep Testing Machine

An automatic, high-temperature relaxation creep testing machine of 10,000-pound capacity is announced by the Baldwin-Lima-Hamilton Corporation, Dept. M, Philadelphia 42, Pa. The machine offers the advantage of additional lower load ranges with a single pick-up device. The varying electrical output of resistance wire strain gages in the load cell is amplified to drive the pen across the recorder chart. Accuracy is within 1 per cent of reading or 1/4 per cent of full scale, whichever is greater.

The standard recorder on the machine has a 10-inch wide strip chart with 100 divisions for full-scale readings of 10,000, 5000, and 2500 pounds. The 150-foot chart is fed by a constant-speed motor at the rate of 1/4 inch per hour. Loads up to 100,000 pounds per square inch can be applied on standard 0.357-inch diameter specimens. The loading mechanism consists of a motor-driven screw-jack that has a stroke of 2 1/8 inches. 108

Hydroptic Jig Boring Machines

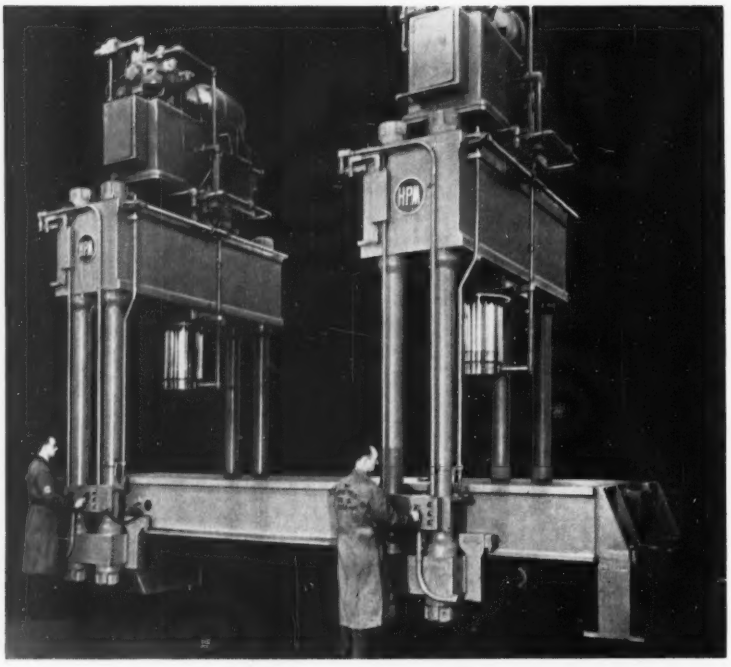
Among the Société Genevoise d'Instruments de Physique machines exhibited at the recent A.S.T.E. Show by the American Sip Corporation, New York City, were the Hydroptic-6 and No. 2P jig borers illustrated in Figs. 1 and 2. These machines embody a new system of coordinate settings on projection screens. The measuring system is based on built-in standard scales having graduations which are optically magnified and projected onto viewing screens. This permits the scales to be easily read at normal distance without eyestrain when making machine settings.



Baldwin machine for testing high-temperature relaxation creep

The Hydroptic-6 jig borer shown in Fig. 1 is intended for high production. It has a working capacity of 40 by 28 inches and will handle heavy precision milling work. Multiple remote control of the spindle and easy coordinate settings reduce non-productivity to a minimum. The hydraulic table motion insures a stepless range of milling feeds and rapid traverse movement.

The small No. 2P single-column machine seen in Fig. 2 is suitable for watchmaking and other fine operations. It has a working capacity of 16 by 10 inches. Designed to provide jig boring and milling facilities, it also constitutes an accurate measuring machine. A special spindle frame serves to eliminate the effects of changes in temperature that occur in the slide. 109



Two-way straightening press built by the Hydraulic Press Mfg. Co.

H-P-M Two-Way Straightening Press

A two-way straightening press with two pressure units—believed to be the first hydraulic press of its type—has been built by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, for the Harvey Machine Co., Torrence, Calif. This press is designed to straighten parts such as forgings, castings, extrusions, and weldments where it is necessary either to hold down one point while applying pressure to another point, or to apply pressure at two points simultaneously.

Spot pressure can be applied over practically the entire press bed area because the two pressure units have both longitudinal and transverse movements. Each unit has a pressure capacity of 400 tons. The bed is 264 inches long and 96 inches wide. From each ram nose (with the ram up) to the bed is 60 inches and each ram has a 24-inch stroke. 110

Hurth Semi-Automatic Milling Machine

Keyways, splines, and slots can be accurately milled at exceptionally fast rates as the result of an entirely new operating principle incorporated in the Hurth LF 32 semi-automatic machine now being distributed in this country by the Kurt Orban Co., Inc., New York City. The period of milling time for keyways ranges from 0.54 minute for a keyway 1/4 inch wide, 3/4 inch long, and 1/8 inch deep to 2.21 minutes for a keyway 1 1/4 inches wide, 2 3/8 inches long, and 7/16 inch deep.

This speed is attained by an alternate lowering and raising of the spindle against set stops, which can be adjusted to very fine tolerances. Vertical displacement of the oscillating movement of the spindle can be adjusted from 0.08 inch to 0. Lowering and raising movements of the spindle are hydraulically controlled.

Operation is automatic except for chucking and removal of work-pieces. When the starting button is pushed, the milling cutter is automatically fed toward the work-piece in rapid traverse. Just before touching the work-piece, the spindle is automatically switched to the boring feed until the predetermined depth of cut is reached. The spindle is then lowered against the first set stop, and the carriage traverses to the end of the slot. The spindle is next raised against the upper set stop and return traverse begins.

Semi-automatic milling machine introduced by Kurt Orban Co., Inc.

For more information on these products, use Inquiry Card, page 247

When the carriage reaches the starting point, the spindle is lowered to the mid-point of the slot, the spindle sleeve is retracted in rapid traverse, and the milling spindle stops.

The milling carriage has a maximum horizontal movement of 15 inches. Maximum manual vertical adjustment is 4 inches and automatic vertical adjustment is from 0 to 0.075 inch per minute. There are fifteen spindle speeds ranging from 90 to 2240 R.P.M. Deep feed rates of the spindle are 0.00059, 0.00118, and 0.00236 inch per revolution. The longitudinal feed of milling carriage has twelve rates, either from 0.49 inch to 6.3 inches per minute, or from 0.98 inch to 12.6 inches per minute. 111

Pangborn Steel-Sheet Blasting Machine

The Pangborn Corporation, Hagerstown, Md., has announced an ES-503 Rotoblast machine for cleaning steel sheet and plate up to 54 inches in width at a production rate of 20 to 80 lineal feet per minute. This machine has been developed to obtain improved finish on steel sheet, provide a better bonding surface for paint, and reduce costs through the use of hot-rolled rather than cold-rolled sheet. It is equipped with two Rotoblast wheels that throw 160,000 pounds of abrasive per hour and will clean more than 200 square feet of sheet per minute.

The steel sheet or plate is taken into the blast chamber automatically; its surface is blasted and all abrasive removed from the sheet before discharge from the machine. The abrasive cleaning operation is accomplished by means of a blow-off fan, indicated in Fig. 2, which deposits the abrasive in a spiral conveyor. It is moved to an elevator that carries it up through the abrasive separator and reclaimer for recycling. Standard equipment includes two wide-vane wheels, each driven by a 50-H.P., 1800-R.P.M. motor. The machine can also be ordered with smaller size Rotoblast wheels, when production requirements are lower. The machine is about 22 feet high, 18 feet wide, and 15 feet long. .. 112

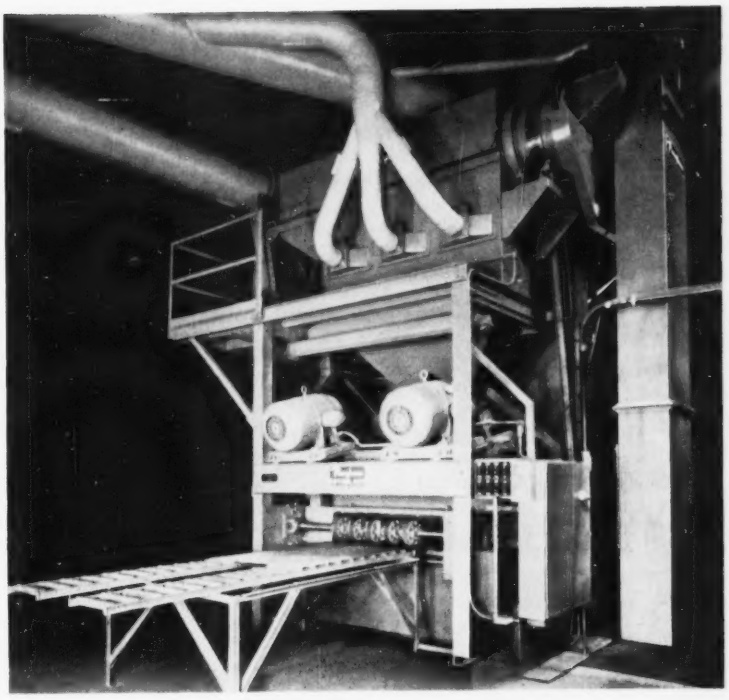


Fig. 1. Pangborn Rotoblast machine for cleaning steel sheet

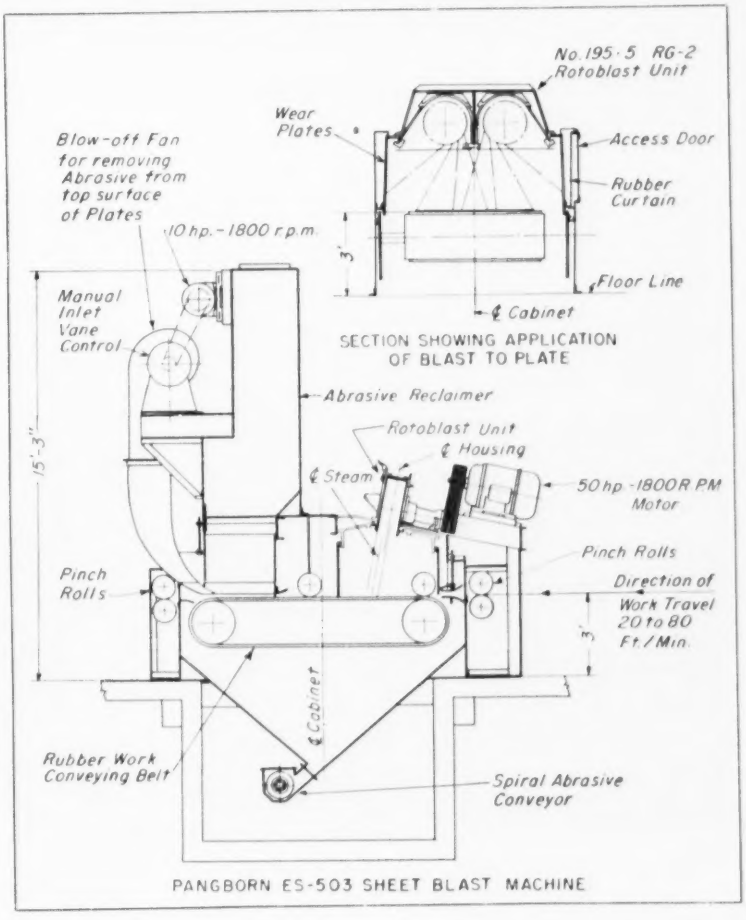


Fig. 2. Cross-sectional views of Pangborn machine, showing arrangement of the abrasive blasting and work-conveying units

Electric Gage for Automatic Size Control of Cylindrical Grinders

An electric grinding gage, containing many design improvements, is now being manufactured by the Federal Products Corporation, Providence, R. I. The use of this gage is said to eliminate scrap and rework. With the grinder controlled by the accurate Electricator of this gage, installed as shown in the accompanying illustration, every piece can be ground to the proper size.

The gage, designated the Model 133M Series, is made up of an Arnold grinding gage frame and caliper, a Federal Electricator, and a power or control unit. The Electricator is basically a dial indicator combined with an electric switch which is connected directly to the power unit.

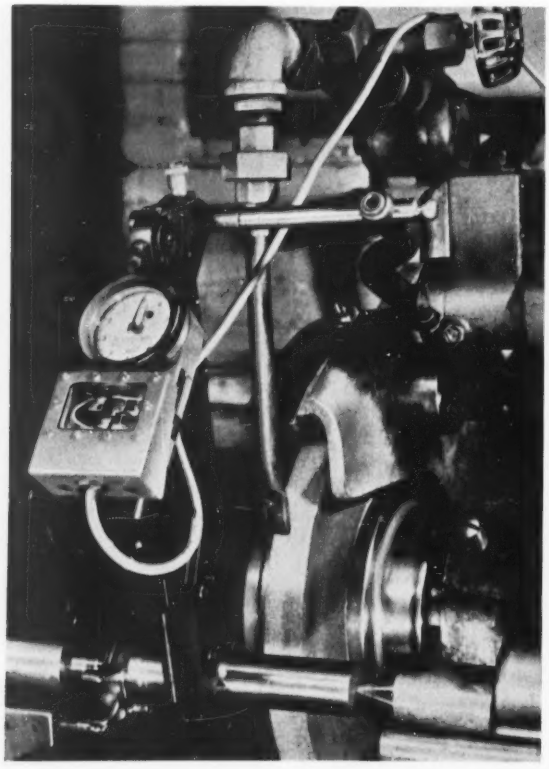
In using the gage, the operator need not stop the work. Automatic control of the grinder begins as soon as the gage is snapped on the work before the work cycle is started, while the wheel is coming forward, or while the work is being ground. The gage rides the work during the grinding operation and through its power unit controls the wheel-head feeding mechanism of the machine.

The wheel-head runs at a rapid grinding rate until the work diameter is reduced to between 0.0005 and 0.004 inch of the final size. Choice of the change-over point depends on the grinding speed. At this point, the wheel is switched by the gage control to a slow spark-out feed. Once the final size is reached, the wheel is automatically retracted. With this method, the back-up point is determined by the actual size of the work-piece rather than through the use of a timed cycle. It is said to be possible to maintain accuracies of 0.00005 inch over a prolonged period of time. 113

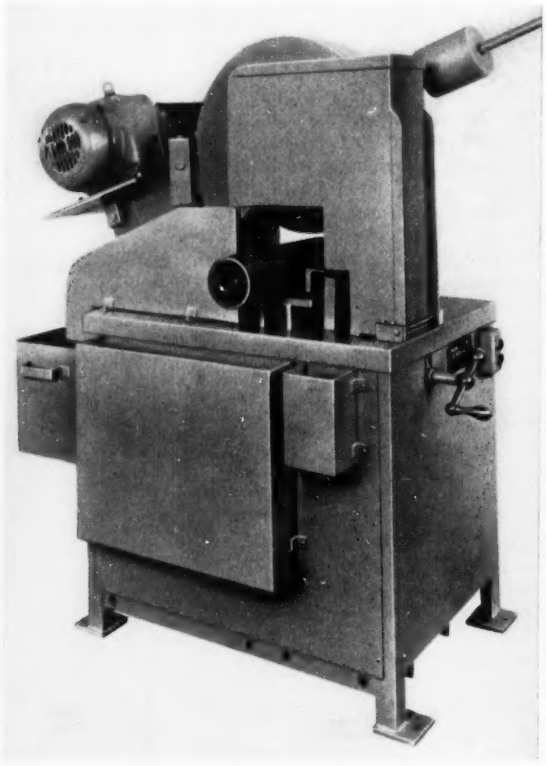
Campbell Dry Abrasive Cutting Machine

The Campbell Machine Division, American Chain & Cable Co., Inc., Bridgeport, Conn., has recently designed a dry abrasive cutting machine, designated the Campbell No. 28 "Sever-All." This compact 62-inch high machine is available in stationary and portable types and has ample capacity for cutting solid steel bars up to 4 by 4 inches, angles and channels up to 8 inches, and tubes and pipes up to 4 inches outside diameter. Angles and channels up to 4 1/2 inches and pipe having outside diameters ranging up to 4 inches can be cut at an angle of 45 degrees. Hand-operated self-centering work-holders clamp the work on both sides of the cut. A foot-actuated treadle can also be furnished for operating the work-holders. The cutting time is approximately three seconds per square inch of material cut.

Operator protection is provided by totally enclosing the cutting wheel except for work clearance openings on the sides of the guard. The provision for lowering of the guard has two advantages: work can be accurately located with relation to the wheel; and long pieces can be placed directly in the machine. Sever-All is furnished with a 7 1/2- or 10-H.P. motor. 114



Federal electric gage designed for the automatic size control of cylindrical grinders



Dry abrasive cutting machine brought out by Campbell Machine Division, American Chain & Cable Co., Inc.

For more information on these products, use Inquiry Card, page 247

Chambersburg Steam Drop-Hammer

The Chambersburg Engineering Co., Chambersburg, Pa., has completed one of three 40,000-pound steam drop-hammers being built for the United States Air Force. These hammers have newly designed frames. A special ram that measures 70 inches front to back brings the total falling weight to 40,000 pounds. The cap measures 80 inches front to back, the cylinder bore 38 inches, and the stroke 65 inches.

Minimum die space is 22 inches and the space between guides, 48 inches. The hammer stands 26 feet 4 inches above the floor and weighs about 1,200,000 pounds. The anvil weighs about 875,000 pounds, and consists essentially of an upper steel forging mounted on two sub-bases.

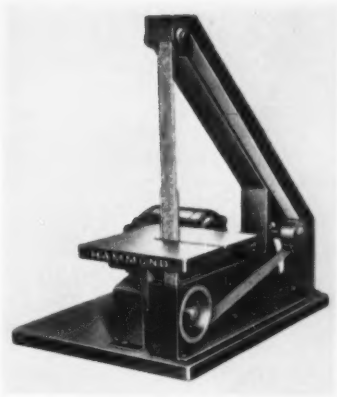
The new design of the frames is the result of engineering studies that have been in progress in the company's laboratories for several years. In these studies, four types of frames were compared, extensive photoelastic tests being made under both static and dynamic loads. The models tested were made of 1/4-inch Catalin made to one-sixteenth the actual size at the cross-section where the top of the ram strikes the column on off-center blows. 115

Horizontal Production Milling Machine

A new type Steinel horizontal production miller, designated the Model SH4AE, is being introduced in this country by the Morey Machinery Co., Inc., New York City. This machine has power feed with rapid approach. There are eight feeds which are independent of the spindle speed.

Adjustable stops change the table travel automatically to the selected power feed and stop it after the work is completed. Quick reverse movement to the loading position follows when the position of the feed-lever is changed. The table can also be advanced to the working position by hand.

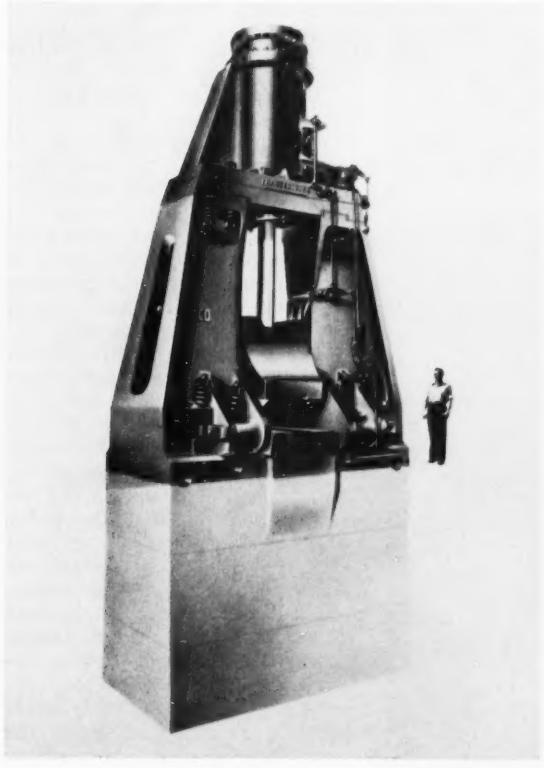
The machine has one drive motor and one feed motor. Equipment includes belts, adjustable limit stops, trip-dogs, coolant pan covers, and a 1-inch arbor. .. 116



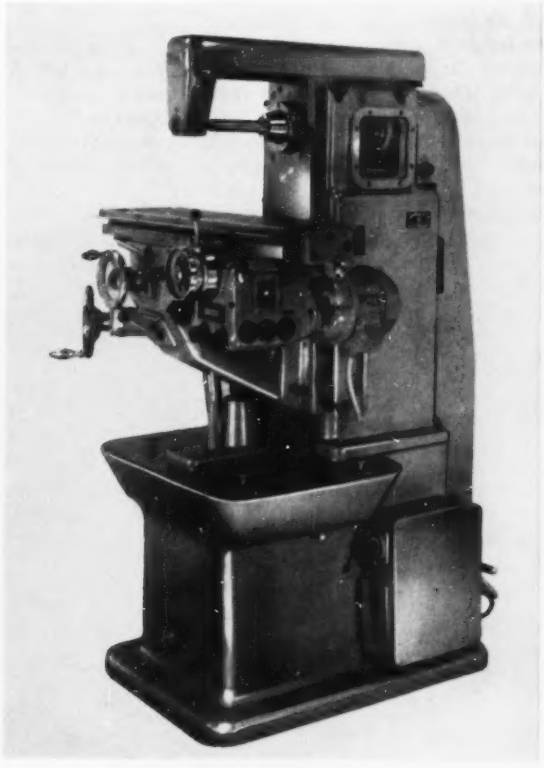
Abrasive belt grinder-polisher made by Hammond Machinery Builders

Hammond Flexible Abrasive Belt Grinder-Polisher

A 1-inch flexible abrasive belt grinder-polisher has just been added to the line of abrasive belt machines made by Hammond Machinery Builders, Dept. M, 1600 Douglas Ave., Kalamazoo, Mich. This Model F-1 machine is designed for deburring, grinding, and polishing. Its 10 1/2-inch



Steam drop-hammer built for the United States Air Force by the Chambersburg Engineering Co.



Steinel production milling machine introduced in this country by the Morey Machinery Co., Inc.

For more information on these products, use Inquiry Card, page 247

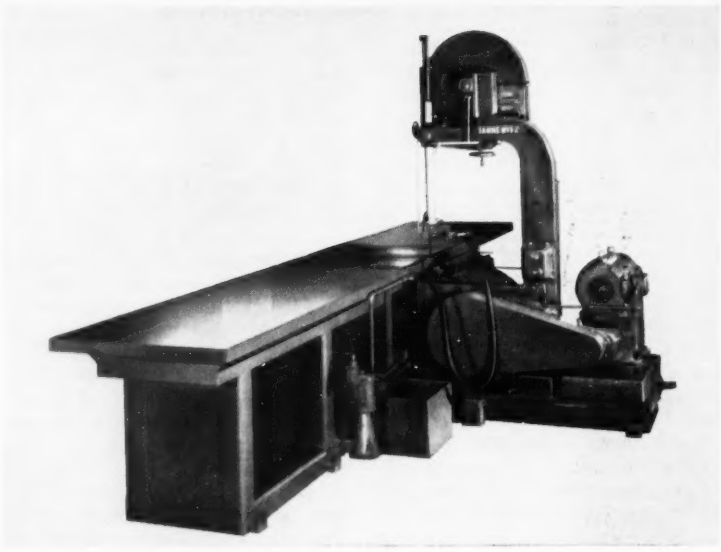
throat depth permits finishing of hard-to-get-at areas.

The work-table and belt platen permit accurate grinding of flat surfaces. Irregular contours can be ground on a "free" belt by removing the platen and work-table. This machine is well suited for tool-rooms, machine shops, maintenance departments, and sheet-metal shops. It is available in either a bench or a floor model and with a built-in dust collector. 117

Metal-Cutting Band Saw With Extra Long Table

The Tannewitz Works, Grand Rapids, Mich., recently built a band saw with a table 19 feet long. This machine is designed specifically for cutting off sections of cellulose acetate 24 inches in diameter. According to the manufacturers, it can also be used to advantage in cutting off steel and aluminum structural members, graphite blocks, and a variety of other materials.

Basically, this is a 30-inch variable-speed band saw that can be run at any desired speed in a ratio of 6 to 1. The hydraulically operated sliding base has a travel of 30 inches. The saw blade can be fed in to the center of the table where it is given a 90-degree twist. The rate of travel is from 0 to 8 inches per second. The table is 43 inches deep. It extends 129 inches to the left and 99 inches to the right, making a total distance of 19 feet.



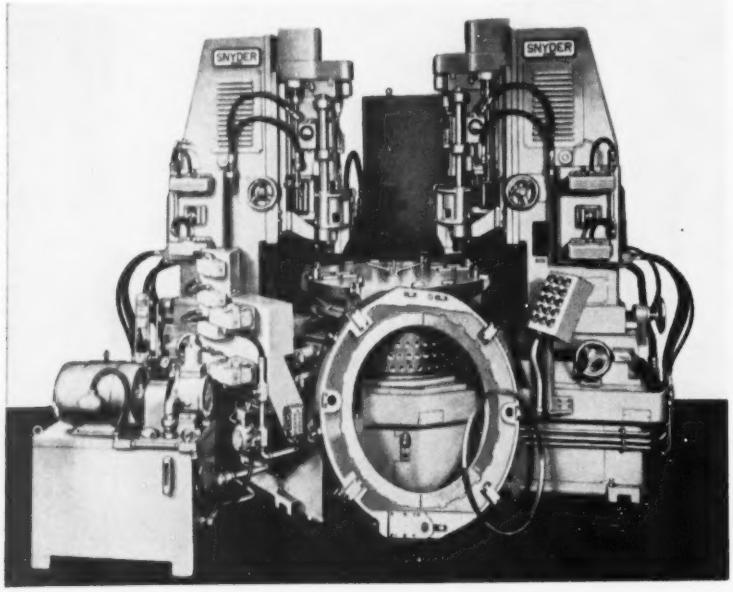
Band saw with extra long table made by the Tannewitz Works

A clearance of 27 inches is provided between the table and the upper guide. A coolant pump and a tank are standard equipment, as are automatic two-wheel brakes which stop the wheels instantly in case of saw-blade breakage. 118

Snyder Multiple-Station Automatic Machine for Processing Jet-Engine Shroud Spacers

A multiple-station, automatic machine which drills and reams holes in the rims of outer shroud spacers for jet engines, and which is adaptable to the processing of other similar parts, has been announced by the Snyder Tool & Engineering Co., Detroit, Mich.

The work-piece, in this particular instance, consists of a thin-walled ring of stainless steel. The operation is to drill and ream holes that are located around the part on both sides of the rim. The spacing between holes varies from part to part, being uniform in some parts and irregular in others. However, all hole spacing is in multiples of a specific angle.



Snyder multiple-station automatic drilling and reaming machine

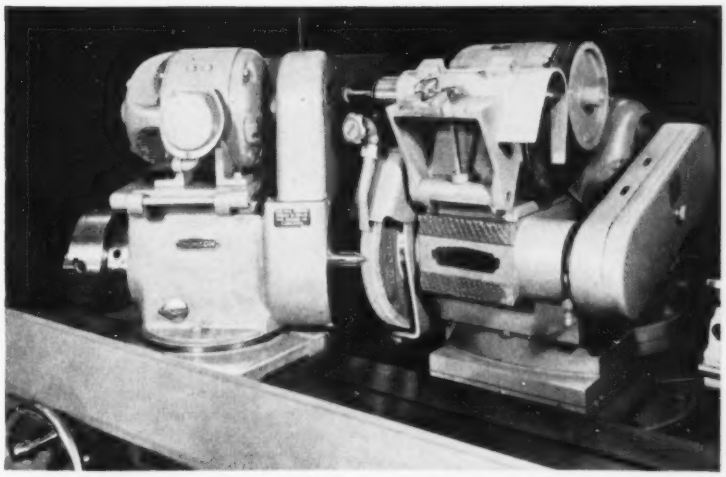
The machine is equipped with a fixture mounted on an index table between columns that support hydraulic drill units. The fixture and the work-piece are shown in front of the machine in the illustration. The columns are adjustable for different size parts. The work-pieces are clamped manually in jigs that completely surround them. The whole assembly is then located over pins and securely clamped in the fixture. In this position, the part is concentric with the index table.

The index table is designed to produce minimum indexes of the basic hole-spacing angle. Four shot pins and four rows of shot-pin holes are used to accomplish this. A drum is used to control the

For more information on these products, use Inquiry Card, page 247

index and select the proper shot pin for locating the table, and also to signal the drilling or reaming unit at the right time. The drum has seven rows of pins spaced around a cylinder approximately 36 inches in diameter. These pins make electrical contacts which actuate sensitive relays that control the operation of the machine. An individual drum is required for each hole pattern. The present machine is tooled up for processing twelve individual parts. By changing the shot-pin rows and control drum, other similar parts can be run on the machine. Production on the present part is two work-pieces an hour.

Spindle speeds are variable from 640 to 2240 R.P.M., and feeds are variable from 1.75 to 12 inches per minute. 119

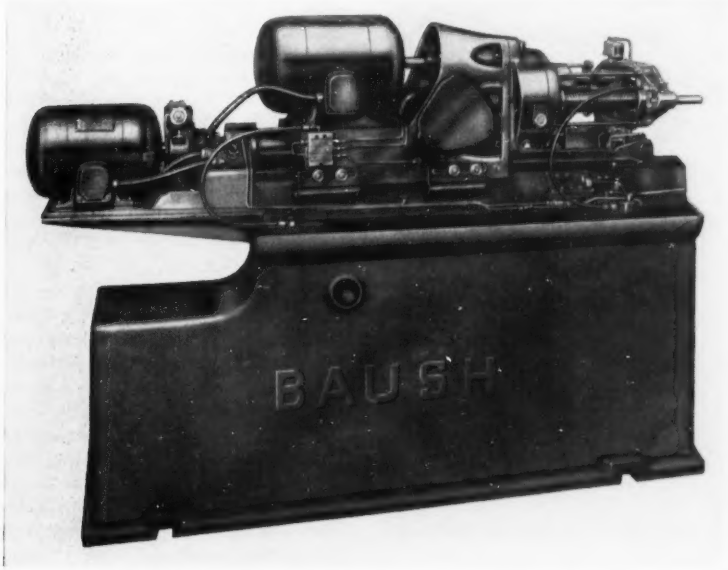


Norton universal grinding machine with swiveling headstock and double swivel on wheel-slide. Internal grinding head swings out of the way.

Baush Mechanical Power Drilling Unit

Features of the 7 1/2 mechanical power drilling machine brought out by the Baush Machine Tool Co., Springfield, Mass., include a Meehanite base with hardened and ground ways, a cast-iron housing with driving gears, pick-off gears and a feed-nut, and a brake arrangement that holds the feed-screw stationary as the nut revolves during the feed cycle. This machine has a rapid traverse of 7 1/2 inches per second and a standard stroke of 18 inches. Spindle drive motors range from 3 H.P. at 900 R.P.M. to 7 1/2 H.P. at 1800 R.P.M. The rapid-traverse drive is by a 1-H.P., 900-R.P.M. motor. The feed is variable, from 1 to 80 inches per minute, using an 1800-R.P.M. spindle motor.

The unit can be used for drilling, boring, reaming, and milling. It can be adapted for installation on transfer line-ups; rotary set-ups; and trunnion, vertical, angular, and horizontal type machines. Units having a wide range of speeds and feeds, and varying numbers of drills are available for drilling holes from 1/4 to 1/2 inch in diameter. 120



Baush mechanical power drilling unit with horizontal base

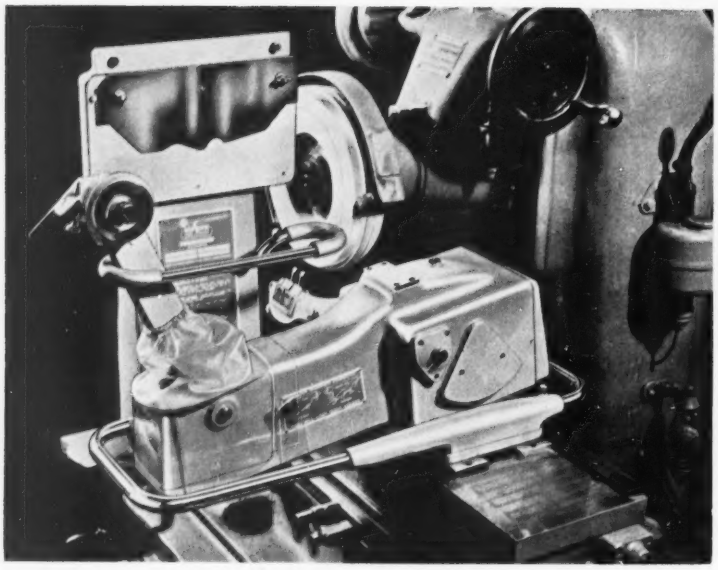
Norton Grinder with Swiveling Headstock

The Norton Co., Worcester, Mass., has announced a 12-inch Type U-4 universal grinding machine designed to provide extra versatility through simplified set-ups and fast, precise grinding action for limited production items. The principal new feature is the swiveling headstock with a dog-drive plate on one end for conventional grinding and a 5-inch D-1 cam-lock nose on the other end for mounting chucks or fixtures. To change from a dog-drive set-up to a chucking operation, the headstock is rotated 180 degrees. When work is being ground on dead centers, the chuck does not rotate because the headstock is of the combination live and dead center type.

A work speed range of 40 to 400 R.P.M. in an infinite number of increments is available at the turn of a dial. No direct-current source is required as rectifiers convert alternating current for the headstock drive control. Quick changes to and from internal grinding are made possible by the hinged bracket internal grinding spindle which is readily lowered into position for use. This permits performing both internal and external grinding on the same piece without changing the set-up.

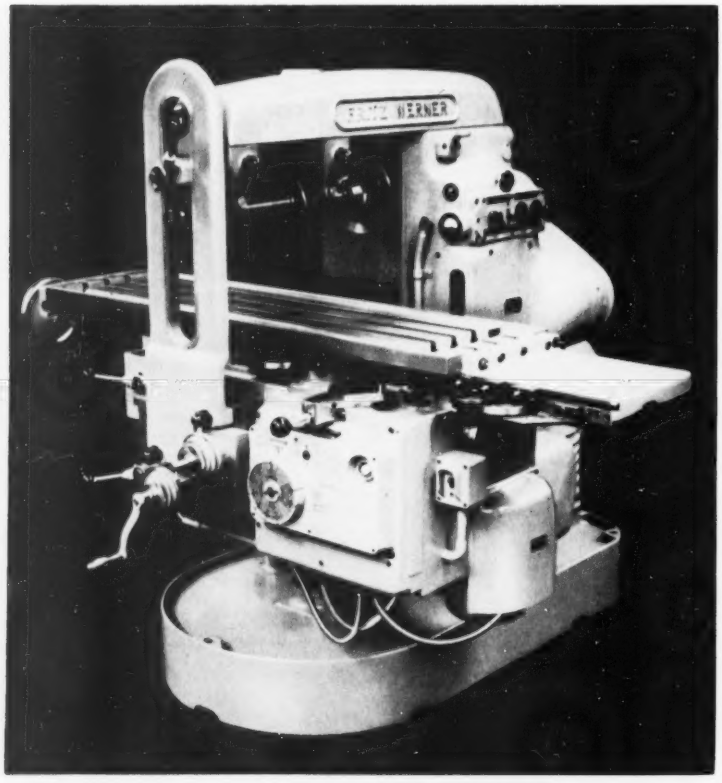
Long shafts are accommodated by means of a 1 1/4-inch hole through the headstock spindle. The grinding wheel head itself has two swivel mountings, one for the wheel-head to regulate the angle of the wheel with relation

For more information on these products, use Inquiry Card, page 247



Pratt & Whitney Model No. 2 Diaform wheel forming attachment

to the work, and the other below the wheel-feed mechanism to regulate the angle at which the wheel is fed into the work. Both mountings are graduated from 0 to 90 degrees each side of the zero position. A power wheel-head rapid-traverse positioning mechanism is also available. The machine is now being furnished completely wired in accordance with J.I.C. electrical standards. 121



Production type milling machine introduced on the market by the Marac Machinery Corporation

Grinding Wheel Forming Attachment

A medium-sized Diaform attachment is being marketed by Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. It form-trues grinding wheels up to 14 inches in diameter, quickly and accurately duplicating forms up to 2 inches wide and 1 inch deep in a single setting. Basically, the attachment is a vertical pantograph operated by tracing a template to guide a truing diamond across the face of the grinding wheel at a 5 to 1 reduction. Two diamonds, mounted in tandem, are used to true the wheel—one for roughing, the other for finishing. The attachment is portable and can be placed on the magnetic chuck or strapped to the table of the grinder for the forming operations. 122

Werner Knee Type Milling Machine

The Marac Machinery Corporation, New York City, is marketing in this country a knee type production milling machine recently brought out by Fritz Werner, Berlin, Germany. This machine has a large selector dial at the front which permits quick set-up of a large variety of automatic and semi-automatic cycles for the longitudinal traverse of the table.

Features include provision for automatic pendulum milling from the center of the table to left and right, with or without spindle reverse. While one piece is being machined, a second piece is being loaded. Settings can be made so that rapid return of the table is obtained automatically or by pressing a switch. Continuous milling can be performed on one or more surfaces either from left to right or right to left. This cycle can be set either for continuous operation or for control by the operator.

Dividing-head milling can be done with rapid approach milling feed, rapid return, and indexing up to a maximum of fifty indexes. After the last index movement, the machine comes to a stop. Several types of dividing heads are available for this operation. An automatic backlash eliminator for use in climb milling is available. The machine has pick-off gears for changing feeds and speeds, and is supplied with a coolant pump and all electrical equipment

For more information on these products, use Inquiry Card, page 247

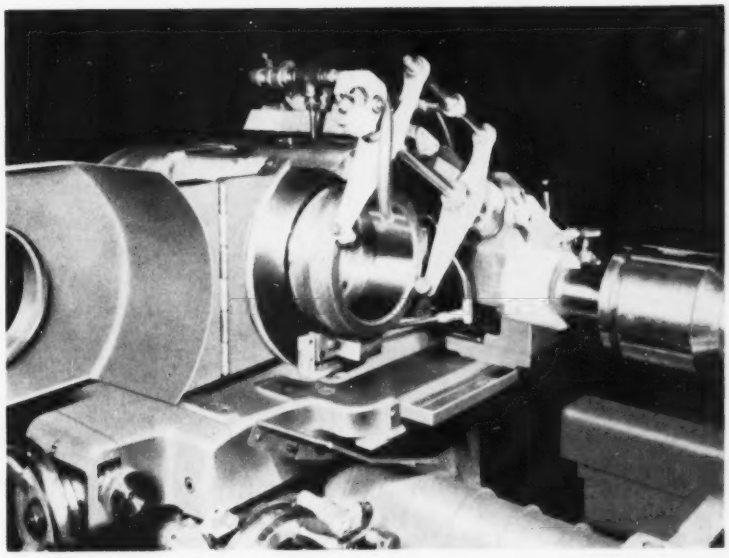
for 220- to 440-volt, 60-cycle, three-phase current.

The table has a work surface 49 by 14 inches and a power traverse of 27 1/2 inches. There are twenty speeds ranging from 22 to 1800 R.P.M. Rapid approach and return speed is 160 inches per minute. The weight of the machine is 4850 pounds. 123

Shoe Centerless Internal Grinding Fixture

The Bryant Chucking Grinder Co., Springfield, Vt., has announced that a fixture for applying the shoe centerless internal grinding method described in January, 1954, MACHINERY, page 178, is now available as tooling equipment on Bryant machines. This fixture insures bore grinding to a uniform wall thickness, and concentricity that can be held within accuracy limits as close as 0.0001 inch or less. Roundness and straightness of the ground bore depend on the accuracy of the outer surface of the workpiece and the squareness of the locating face.

Shoe centerless internal grinding is useful in applications that require close tolerances for concentricity, and bore roundness and squareness, especially where previous external cylindrical and face grinding operations have been precisely controlled. Straight and taper holes, and plunge-ground contours can also be ground. The outer surfaces of the work can be cylindrical, conical, or of any other form so long as they are uniform within the tolerances required. Thin-walled rings can be shoe centerless internally ground to close tolerances because this method of supporting the work also reduces the possibility of distortion. Additional advantages include easy manual or automatic loading and unloading of work. 124

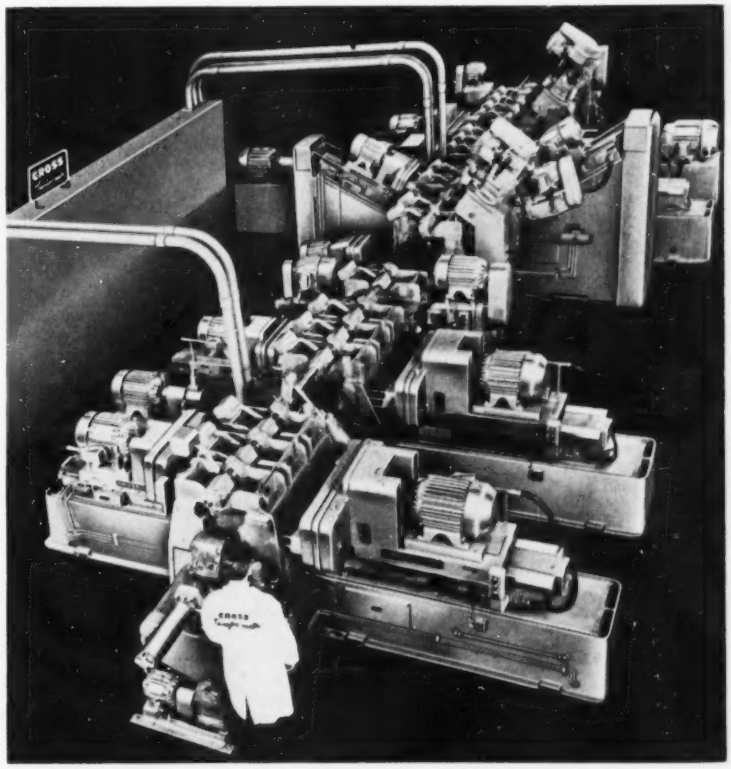


Bryant machine equipped with shoe centerless internal grinding fixture

Cross Machine for Transmission Housings

A twenty-nine station machine of the transfer type has been built by The Cross Company, Dept. M, Detroit 7, Mich., for use in producing automatic transmission housings. A series of drilling, chamfering, end-milling, counterboring, reaming, and tapping operations are performed by the different units. At one station, the machine indexes the work 90 degrees for subsequent operations.

Pre-set tools are used, and a Cross machine control unit with Toolometers programs tool changes. Other features include automatic transfer from station to station; hydraulic feed and rapid traverse; individual lead-screw feed for tapping; and gravity-operated cam clamping. A chip conveyor is built in. The machine has a capacity for 100 pieces per hour. 125



Cross transfer type machine that uses pre-set tools in the production of automatic transmission housings

"Connecticut" Press Brake

W. Whitney Stueck, Inc., Old Saybrook, Conn., has developed an improved sheet-metal bending brake for production runs, to be known as the "Connecticut" press brake. This machine is driven by a 3/4-H.P. motor, and will bend 16-gage mild steel 4 feet wide over a 1/2-inch die opening, or 10-gage material 2 feet wide over a 1 1/8-inch die. The brake has a speed of forty strokes per minute. Deflection is minimized by a support for both ends of the main crankshaft. A reversing switch permits the ram to be backed off in case of jamming.

A back gage built in as standard equipment can be easily operated from the front of the machine. This permits rapid, accurate resetting to speed up production on varied bending operations required in the manufacture of electrical and electronic equipment cabinets, panels and chassis, prefabricated ducts, angles, channels, and tanks. The press brake can also be adapted to multiple punching within its capacity.

Standard features include Oilite bearings on all shafts, anti-friction bearing mounting of the flywheel, and a 32-inch clearance between the side frames. The maximum die space is 7 inches, stroke 2 inches, and adjustment 1 1/2 inches, giving a shut height over the die-block of 3 1/2 inches. . .126

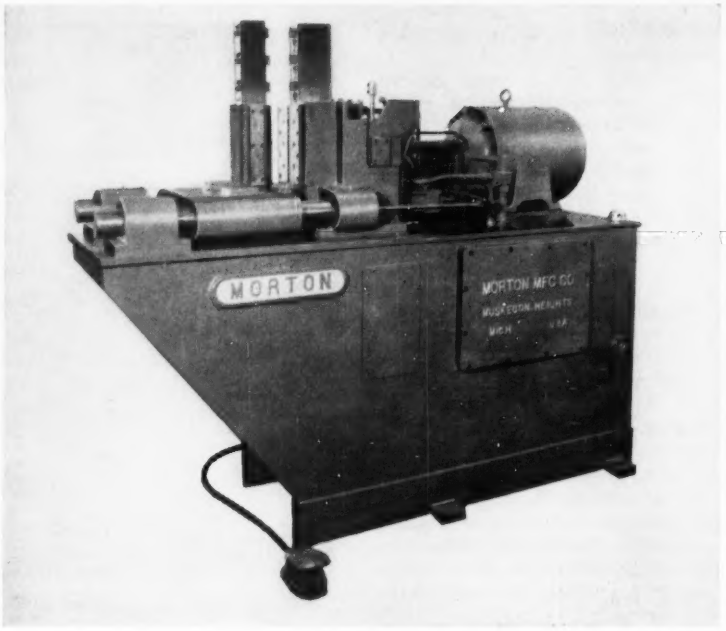
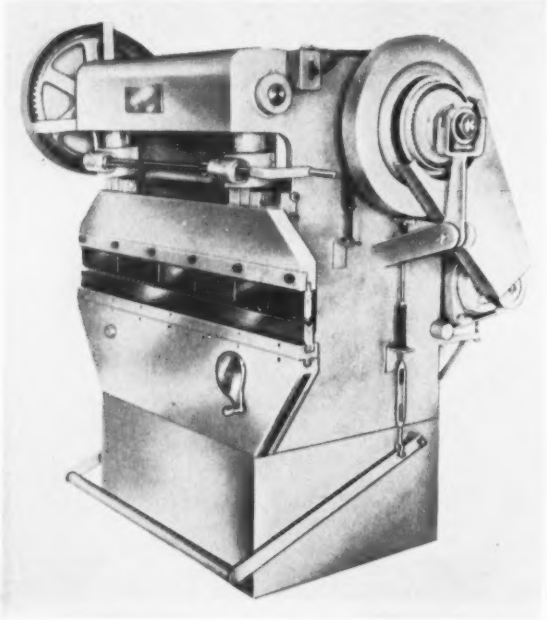


Fig. 1. Flash trimming machine brought out by the Morton Mfg. Co.

Morton Flash Trimming and Girth Welding Machines

A special vertical flash trimming machine and a universal girth welder are recent developments of the Morton Mfg. Co., Muskegon Heights, Mich. The flash trimming machine, shown in Fig. 1, is designed for use in removing flash from the inside and outside of thick-wall welded rings and cylinders. This trimmer has a capacity for trimming the flash from cylinders having wall thicknesses from 1/4 to 3/4 inch, and sizes ranging from a minimum inside diameter of 6 inches to a maximum outside diameter of 24 inches. It is made for trimming cylinders 4, 7, and 10 inches long.



"Connecticut" press brake built by W. Whitney Stueck, Inc.

Fig. 2. Morton universal girth type welding machine

For more information on these products, use Inquiry Card, page 247

This machine is hydraulically operated. The piece to be trimmed is placed over the inner clamp member and ram. A foot-operated push-button starts the cycle and the inner ram member moves forward hydraulically to clamp the cylinder. Both rams automatically trim on the draw-cut downward stroke. At the end of the cutting or trimming stroke, the inside ram and clamp dies move to the unclamping position and the outside rams to the loading position.

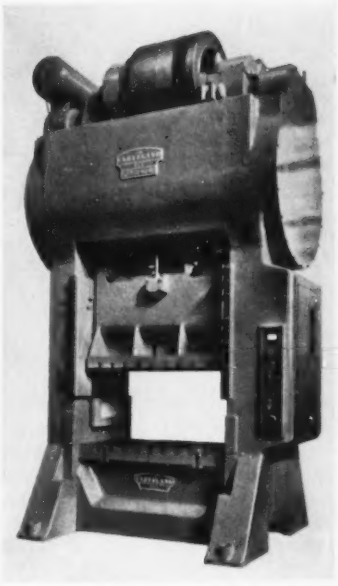
An alternating-current 15-H.P. motor and control equipment provide suitable power for operating the machine. An approximate cutting speed of 60 feet per minute with a 2 to 1 quick return is used.

The girth welder, Fig. 2, consists primarily of a standard heavy-duty positioner mounted on a common base with a vertical column designed for very flexible weld-head positioning. The positioner has a wide range of table rotary speeds. A hole bored completely through the table makes possible the application of air, oil, water, or gas through rotary joints for operating special fixtures. Jig-located drilled and tapped holes on the table surface provide for interchangeable fixture mounting applications. . .127

Equipment to Inspect Accounting-Machine Type

A Sigmatic fully automatic machine for high-speed, 100 per cent inspection of accounting-machine type is being introduced in this country by the Cosa Corporation, New York City. This machine can be used for the simultaneous inspection of ten or less dimensions on parts up to 1 by 1 by 2 inches. Illustrated in Fig. 1 is a machine tooled up to inspect a total of six dimensions of type, including length, width, thickness, and straightness. This tool equipment can be removed and replaced in twenty minutes by other tooling for the inspection of internal or external dimensions of different parts.

During inspection, each dimension is checked by a Sigma Microlimit gage, which is accurate to within 0.00005 inch and which can quickly be set to the required tolerances. Parts fed into the machine from hand-loaded magazines are inspected at the rate of 2300 per hour, and when hopper-fed at the rate of 3600 per hour. Inspected parts are automatically separated into three groups—over-size, under-size, and acceptable. 128



Two-point twin drive press

Cleveland Two-Point Press

A two-point, double-geared press of twin drive design equipped with an electrically controlled air-operated drum type friction clutch with a spring-loaded brake has been brought

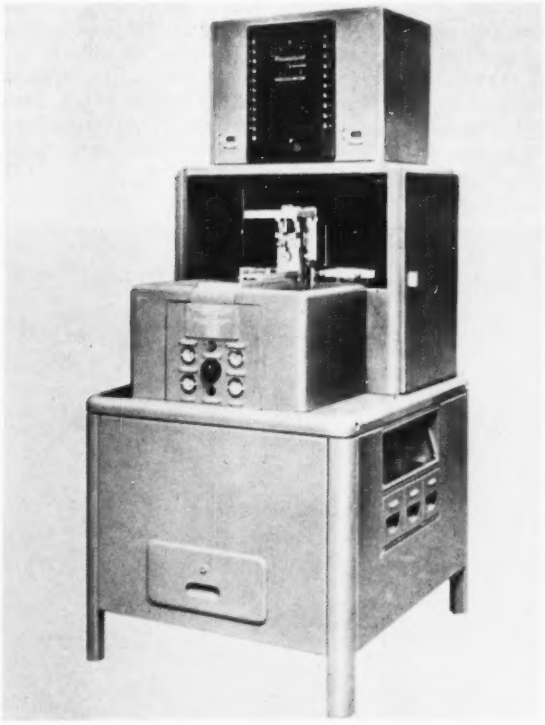


Fig. 1. High-speed small-parts inspection machine was recently introduced by the Cosa Corporation

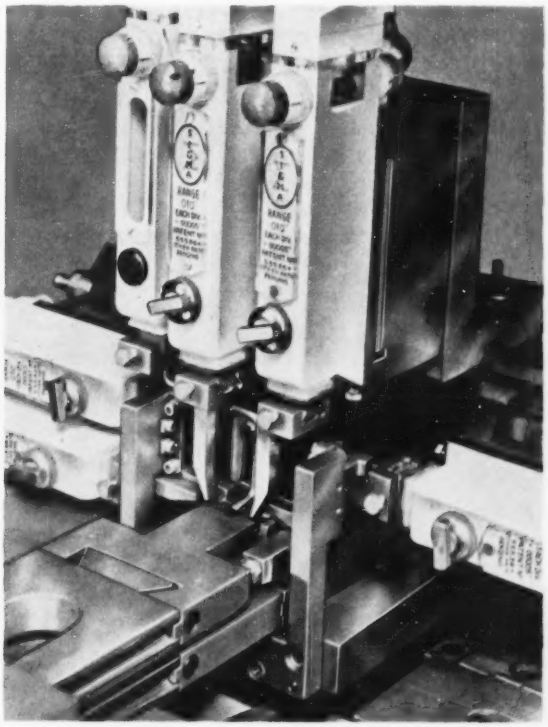


Fig. 2. Close-up of tooling used on machine shown in Fig. 1 for inspecting six dimensions of type

out by the Cleveland Punch & Shear Works Co., Cleveland, Ohio. The flywheel of this press is provided with an auxiliary air brake to bring it to a quick stop when the power is shut off. The slide of the press is pneumatically counterbalanced and the press is arranged with two safety blocks which are used when die setting. These blocks are provided with safety plugs so that when the blocks are pulled out the control circuit is made inoperative.

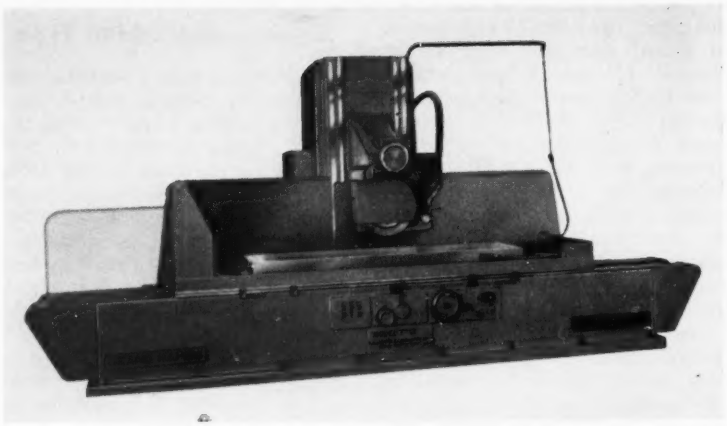
The die area is lighted from both sides. The press has an 8-inch stroke; a 6-inch adjustment; 26-inch distance from bed to slide, with stroke down and adjustment up; and a 42- by 60-inch bed and slide area. This press operates at 20 to 40 R.P.M.; and has a capacity of 350 tons. 129

Delpark Filters Built into New Norton Grinder

One of the problems confronting engineers of the Norton Co., Worcester, Mass., in developing the new Type CM-1 heavy-duty multi-wheel grinder was the elimination or removal of the large amount of swarf from several grinding wheels. This problem was solved by incorporating in the design of the machine certain components of the Delpark filter, which is made by the Industrial Filtration Co., Lebanon, Ind.

The machine, as seen in Fig. 1, uses several grinding wheels for simultaneously grinding different diameters on the work-piece in a single plunge-grind operation. The high sludge load produced is removed from the coolant by the Delpark filter system. This keeps the coolant supplied to the wheels clean and free of the particles which would spoil the finish of the ground work.

The gravity filter system consists primarily of an endless chain belt type conveyor on which rides a strip of disposable filter material. The conveyor forms a trough into which the used coolant falls. As the filter medium becomes loaded with solids, a float control advances the conveyor to bring clean filter material into position. The swarf that has been filtered is collected on the filter medium, which feeds into a metal receptacle, as shown in Fig. 2, for easy disposal. 130



Grand Rapids high-speed production grinder built by Gallmeyer & Livingston Co.

High-Speed Production Type Surface Grinder

Gallmeyer & Livingston Co., Grand Rapids, Mich., has announced a hydraulic feed, cross-traveling head surface grinder designed for high-speed production. This Grand Rapids 24- by 25- by 96-inch machine has a spindle powered by a 30-H.P. motor, which gives the 20-inch diameter wheel a surface speed of 6000 feet per minute. The hydraulic drive motor has a rating of 15 H.P. A Vickers tandem pump actuates the table at speeds from 0 to 150 feet per minute.

A one-shot lubricating system is provided to reduce oiling time to only seconds. A self-contained motor-driven coolant system is standard equipment. 131

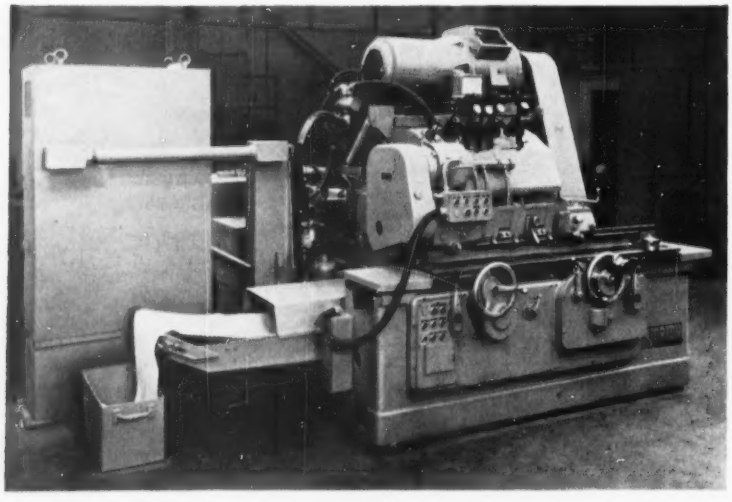


Fig. 1. Norton heavy-duty multiple wheel grinder equipped with Delpark filter system made by Industrial Filtration Co.

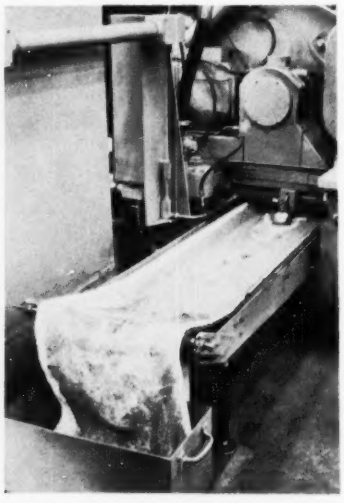
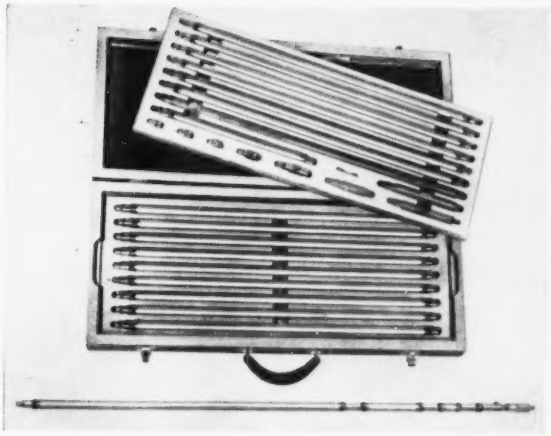


Fig. 2. Swarf filtering medium of Delpark system being discharged

For more information on these products, use Inquiry Card, page 247



Brown & Sharpe inside micrometer consisting of special head and twenty-five extensions

Automatic gear selector announced by Michigan Tool Co., shown with part of front cover removed

Brown & Sharpe Inside Micrometers

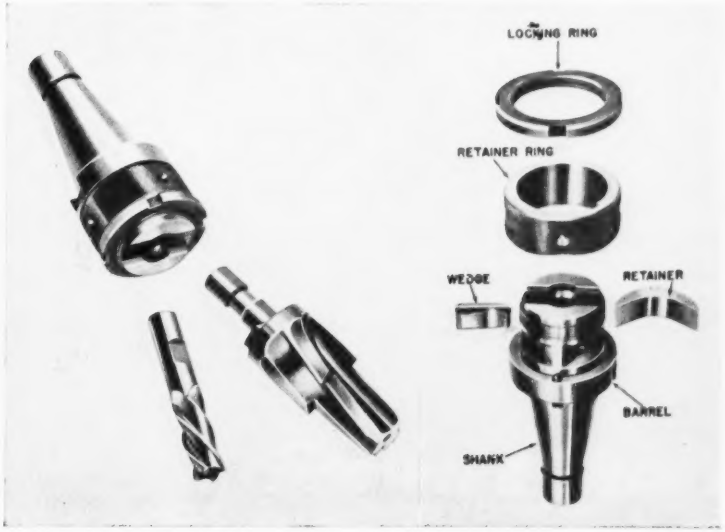
An inside micrometer designed for very accurate measuring of lengths up to 30 feet is being offered on special order by the Brown & Sharpe Mfg. Co., Providence, R. I. This portable instrument will measure any dimension between 6 and 30 feet. A special micrometer head and twenty-five extensions, used in combination, provide for this broad range. In order to minimize inaccuracies in such long members, each extension is calibrated to the nearest ten-thousandth inch, permitting accurate over-all accuracy which is usually far better than that required in such large dimensions. 132

Automatic Three-Way Gear Selector

An automatic gear selector that segregates gears into three categories designated satisfactory, over-, and under-size, is announced by the Michigan Tool Co., Detroit, Mich. This selector can be used to inspect any spur or helical gear at a faster rate than it can be produced on a shaving machine, hobbing machine, gear shaper, or any other gear tooth cutting or finishing machine.

The operator simply feeds gears into the selector, or the gears can be inspected in a fully automatic set-up without requiring any operator attention. The unit can be furnished with an automatic shut-off, coupled with a counter, to stop the production machine if any consecutive gears (the number is optional) are rejected or the percentage of rejects on a given run exceeds set limits. This automatic shut-off can be incorporated in a production line with full automation or with manual feeding of the gears.

Two accurate master gears, one of which is motor-driven, are used to check the gears being produced. The gears being checked are passed between the motor-driven fixed master gear and a second pivoted master gear. The pivoted gear moves in or out as required to stay in contact with the gear being checked. If the movement is within the prescribed limits, the inspected gear rolls down an incline and is deposited in a tote pan or conveyor of the production line. If it is over- or undersize, the gear is diverted by the closing of a baffle to its proper rejected classification exit. .. 133



(Left) Wej-Lok holder with typical cutters; (right) exploded view of holder

Tool-Holder with Actuating Wedge

A Wej-Lok tool-holder is being placed on the market by the Detroit Reamer & Tool Co., Dept. M, 2830 E. Seven Mile Road, Detroit 34, Mich. The components consist of a one-piece barrel, wedge, retainer, retainer ring, and locking ring. The wedge is moved back and forth by the retainer to either lock or unlock inserted tools. A keyed interlocking of retainer and retainer ring causes these two parts to operate as a single unit. In the locked position, the flat surface of the wedge is seated on the shank of the inserted tool. .134

For more information on these products, use Inquiry Card, page 247

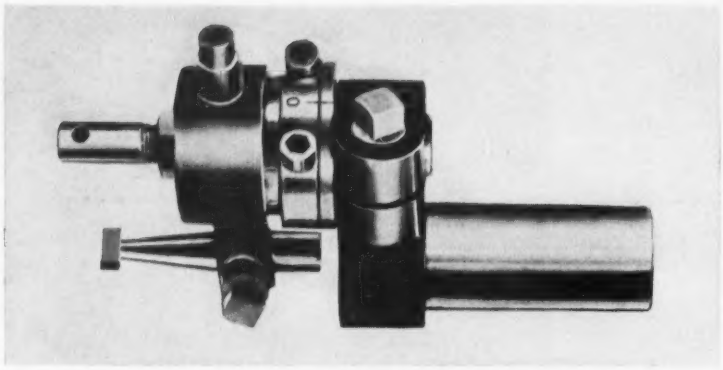


Fig. 1. Versatile, easily operated recessing tool of improved design has been brought out by R and L Tools

Improved Adjustable Recessing Tool

A recessing tool of improved design, Fig. 1, which can be adjusted to operate on any internal diameter within the capacity of the machine, is being manufactured by R and L Tools, Philadelphia, Pa. The tool can also be adjusted to operate on outside diameters for cutting grooves or similar operations.

Operation of the recessing tool can be clearly understood from the cross-sectional drawing, Fig. 2. When the spring-loaded screw *A* comes in contact with the cap over the front end of the machine spindle, it compresses spring *G*, causing a hardened and ground high-speed steel cutting tool *B* to swing either backward or forward depending on which way the machine spindle is revolving. Rotation of the spindle should always be such as to put downward pressure on the cutting tool, which will produce a much steadier action. Part *A* is adjustable and locked in place by lock-nut *H*. Adjustment of cutting tool *B* is accomplished by means of a fine adjusting sleeve *C* that has two cam slots, one for left-hand and the other for right-hand operation. Cam-screw *D* can be engaged in either slot by removing the screw and shifting sleeve *C* so that screw *D* enters the other slot.

The depth of recess cut and the recess diameter settings can be finely adjusted by loosening one and tightening the other of two adjusting screws *E*. A zero reference line is engraved on the adjusting sleeve *C* and intermediate sleeve *F* to show the operator how much and in which direction the cutting tool has been adjusted. The maximum depth of recess that can be cut is approximately 3/32 to 1/8 inch. Shank *J* is fitted with screw *K*, which enables the operator to adjust the entire mechanism of the tool to other diameters.

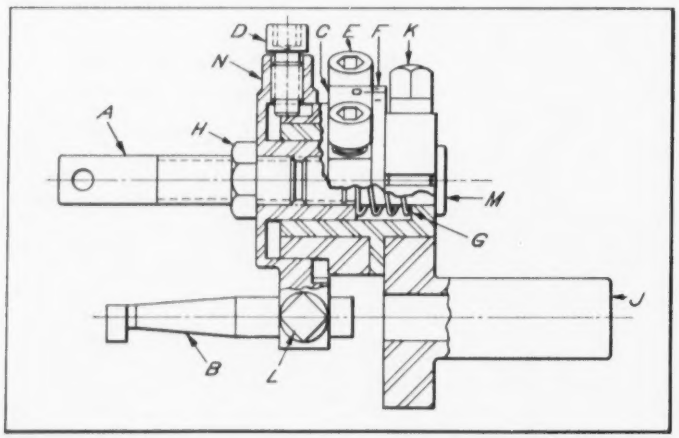
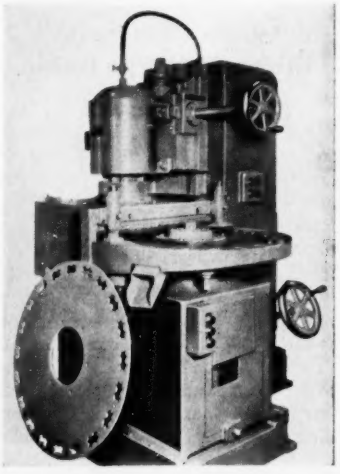


Fig. 2. Drawing illustrating construction and operating details of recessing tool shown in Fig. 1

The main working body of the tool is shown at *N*. Set-screw *L* is used for holding tool *B* tightly in the desired position. The entire tool can be disassembled if necessary by removing screw *M*. The recessing tools are available in three sizes with shank diameters of 5/8, 3/4, and 1 inch. 135

Besly Double Vertical Spindle Grinder

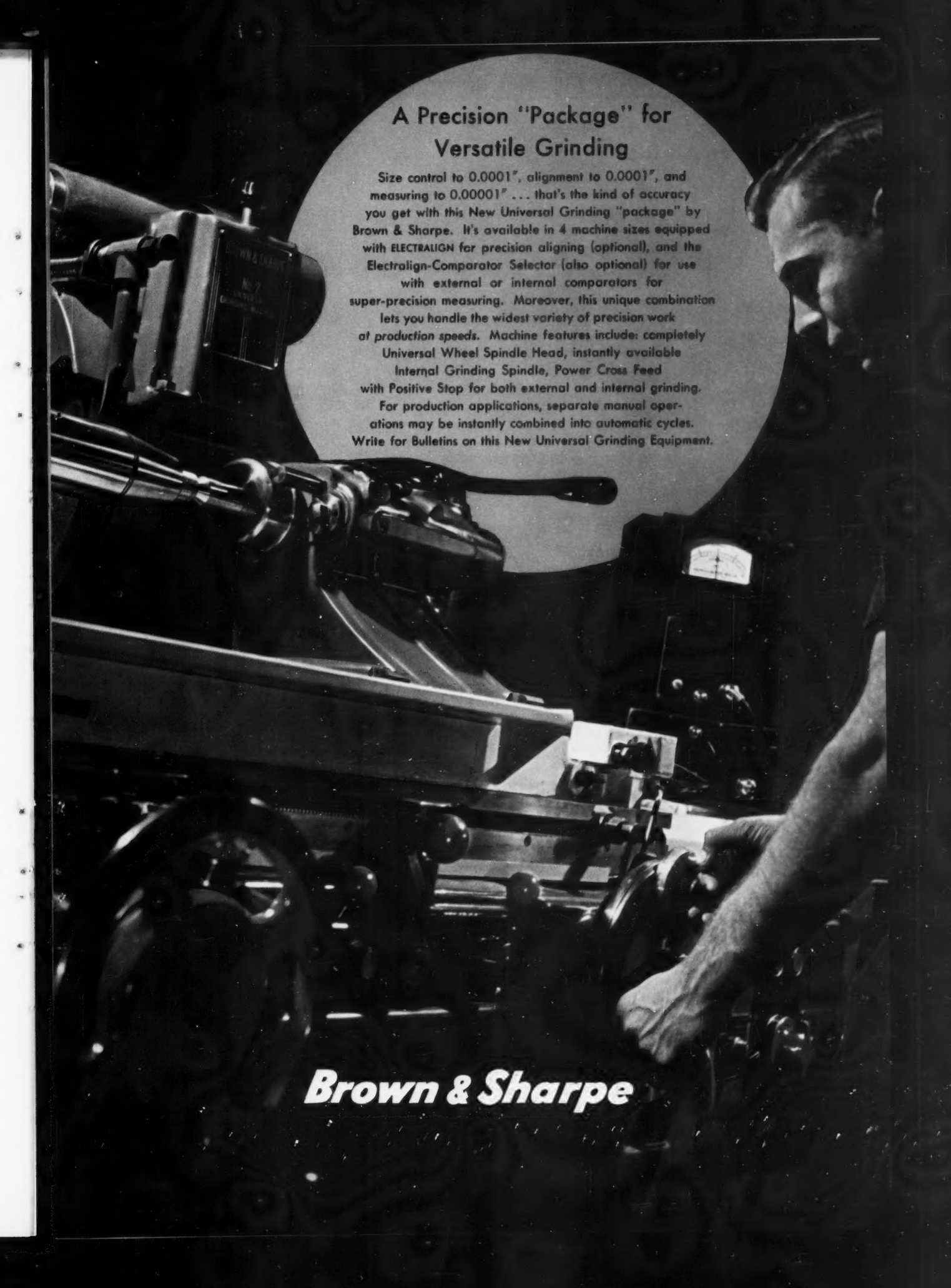
The Besly-Welles Corporation, Beloit, Wis., has brought out a double vertical spindle grinder equipped with two abrasive wheels and a rotary work-carrying or feeding wheel. This machine is designed to permit positioning the rotary wheel so that the path of the work between the abrasive discs can be precisely adjusted. This permits both sides of the work-piece to be ground flat and parallel simultaneously within very close tolerances.



Besly grinder equipped with two abrasive discs for grinding simultaneously opposite sides of work flat and parallel

The machine illustrated is so equipped that the faces of carbon rings and segments are ground flat and parallel within 0.0003 to 0.0004 inch by passing them through the grinder twice. The first pass removes 0.025 to 0.040 inch of stock and the finishing pass removes 0.008 to 0.010 inch of stock. The use of rotary feed-wheels enables the grinder to complete 720 parts per hour. Both wheels are interchangeable, one being used for the carbon rings and the other for the segments.

For more information on these products, use Inquiry Card, page 247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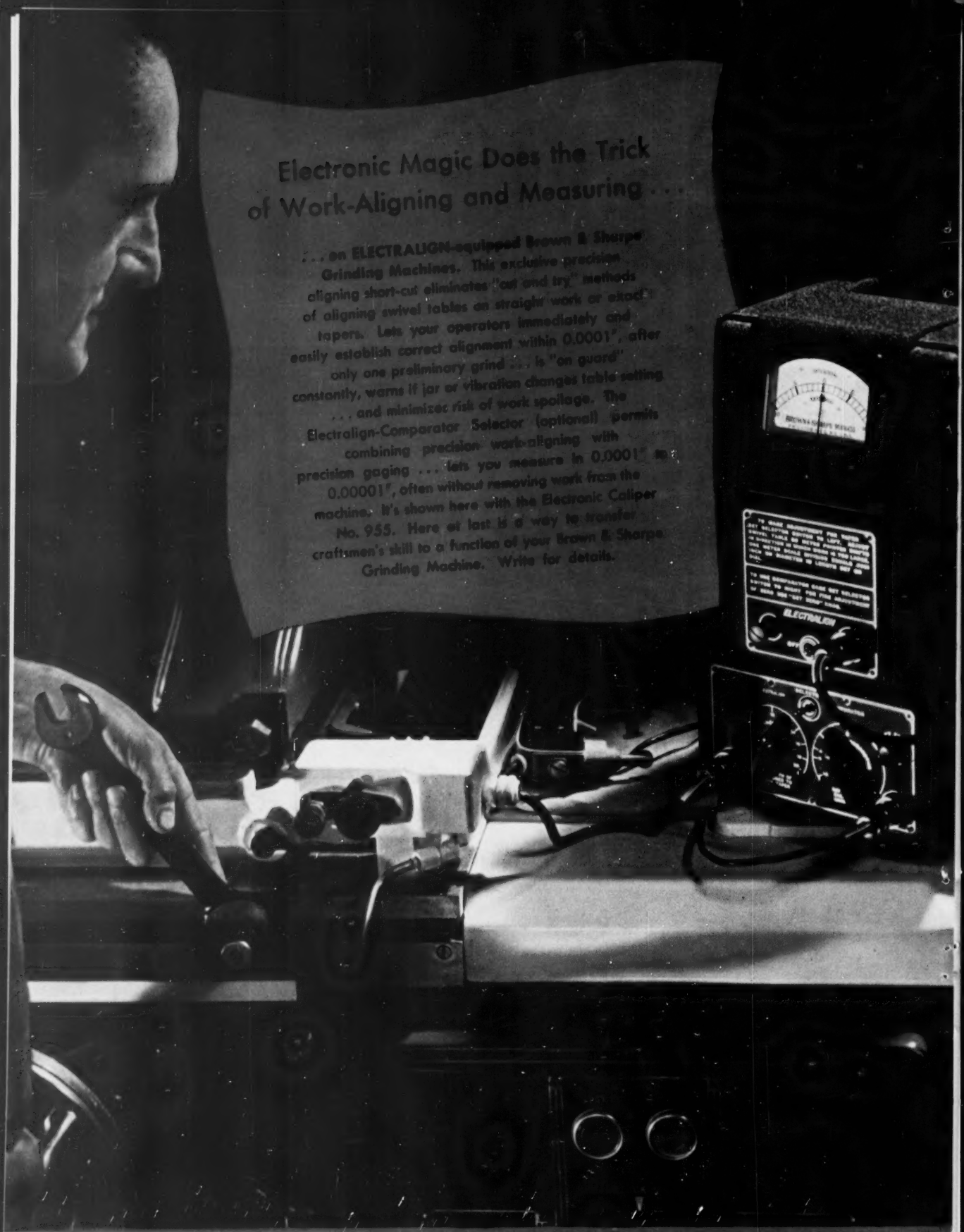
Versatile Grinding
Size control to 0.0001", alignment to 0.0001", and measuring to 0.00001" . . . that's the kind of accuracy you get with this New Universal Grinding "package" by Brown & Sharpe. It's available in 4 machine sizes equipped with ELECTRALIGN for precision aligning (optional), and the Electralign-Comparator Selector (also optional) for use with external or internal comparators for super-precision measuring. Moreover, this unique combination lets you handle the widest variety of precision work at production speeds. Machine features include: completely Universal Wheel Spindle Head, instantly available Internal Grinding Spindle, Power Cross Feed with Positive Stop for both external and internal grinding. For production applications, separate manual operations may be instantly combined into automatic cycles. Write for Bulletins on this New Universal Grinding Equipment.
Brown & Sharpe


Electronic Magic Does the Trick
of Work-Aligning and Measuring . . .
. . . on ELECTRALIGN-equipped Brown & Sharpe Grinding Machines. This exclusive precision aligning short-cut eliminates "cut and try" methods of aligning swivel tables on straight work or exact tapers. Lets your operators immediately and easily establish correct alignment within 0.0001", after only one preliminary grind . . . is "on guard" constantly, warns if jar or vibration changes table setting . . . and minimizes risk of work spoilage. The Electralign-Comparator Selector (optional) permits combining precision work-aligning with precision gaging . . . lets you measure in 0.0001" or 0.00001", often without removing work from the machine. It's shown here with the Electronic Caliper No. 955. Here at last is a way to transfer craftsmen's skill to a function of your Brown & Sharpe Grinding Machine. Write for details.
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Screw Machines • Cutters
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Electronic Measuring Equipment
Johansson Gage Blocks
Permanent Magnet Chucks • Pumps

Printed in U.S.A.

The rotating speed of the feed-wheel can be adjusted for maximum grinding efficiency.

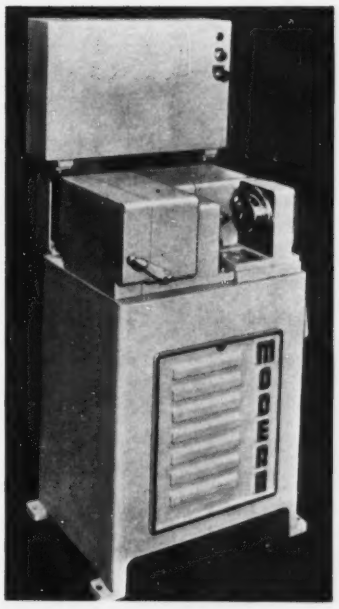
The abrasive discs are 23 inches in diameter and are completely enclosed for operator safety and protection from coolant spray. Coolant is supplied to the work through the center of the upper abrasive disc spindle. 136

Internal Gear Deburring and Chamfering Machine

A universal internal Burr-Master for deburring and chamfering internal splines, or straight-sided or involute form helical or spur gears from 5/8 inch to 3 1/2 inches pitch diameter, has been announced by the Modern Industrial Engineering Co., Detroit, Mich. This machine, designated the BM1-14, can handle internal splines or gears having from nine to forty-two teeth, depending on the tooth pitch. Chamfering of both sides of the tooth and the root is done simultaneously at the rate of five teeth per second.

Long tool life is assured by the use of a circular type form tool having three or four cutting edges. When one cutting edge becomes dull, the tool is merely rotated to present a sharp edge. A positive stop insures that the first gear deburred and chamfered after the cutting tools have been rotated to a new position will automatically meet specifications.

Special interchangeable camming can be furnished, if required, for unusual forms of splines or gears. A 220- to 440-volt, 1/2-H.P., three-phase motor is used to drive the machine. It requires a floor area of 26 by 26 1/2 inches. 137



Universal internal Burr-Master announced by Modern Industrial Engineering Co.

Recirculating Furnace with Built-In Fan

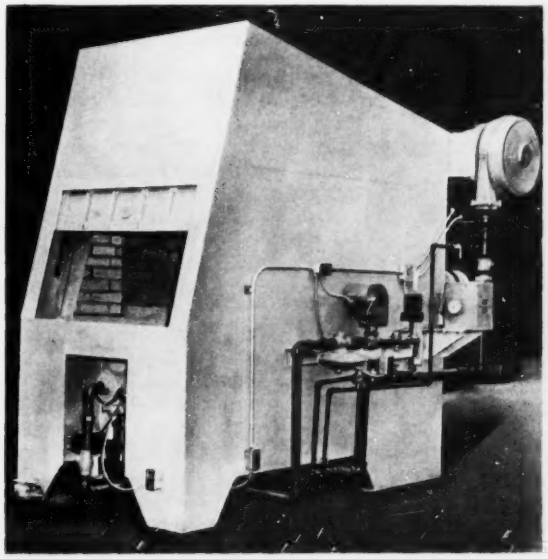
A convection type recirculating forced-draw furnace, designed and built by the Bellevue Industrial Furnace Co., Detroit, Mich., has the fan built into the furnace. Hot gases are recirculated through the work chamber at the rate of seventy complete air changes per minute. The air-operated door has a tight seal around its frame that eliminates any cool area in the furnace.

The temperature range of this furnace is from 250 to 1250 degrees F. Other furnaces of this type are available for operation at temperatures up to 1650 degrees F. in a wide range of sizes and with a variety of equipment .. 138

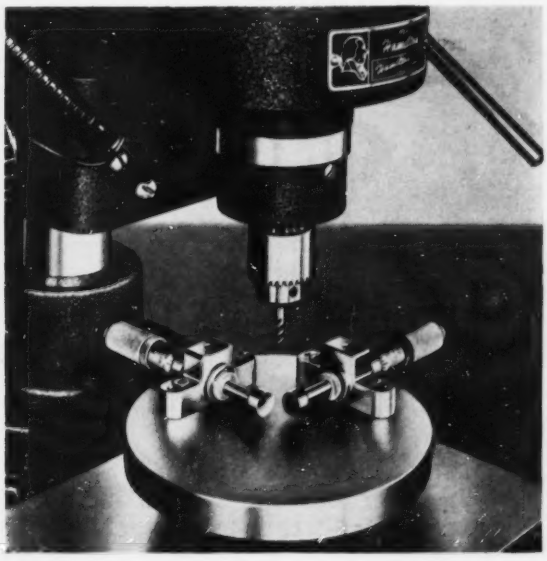
Precision Drilling Machines with Micrometer Controls for Locating Holes

The Hamilton Tool Co., Hamilton, Ohio, has added micrometer control for the positive location of holes to its sensitive small-hole drilling machines. When used for the precision drilling of small units, this equipment will locate one or a series of holes with the assurance of accurate center-to-center positioning of all holes.

The machine illustrated is the Hamilton "Maxi Jr.," which has a capacity for drilling holes from 0.004 to 0.3125 inch in diameter in all drillable materials. Its clearance from the center of the chuck to the column is 5 inches and from the base to the chuck, 10 inches. Spindle speeds range from 750 to 8750 R.P.M. Machines of greater or less capacity can be had. .. 139

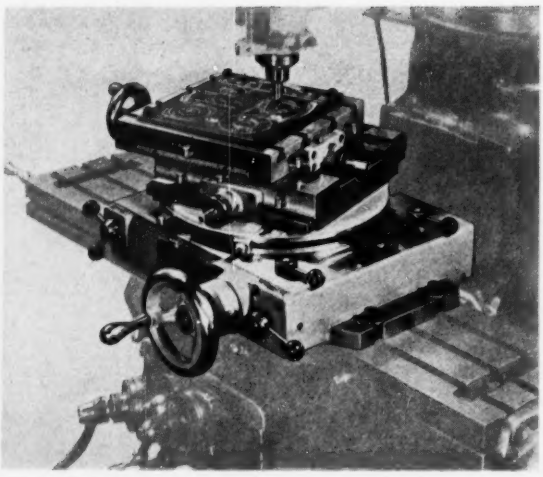


Bellevue modernized recirculating forced-draw furnace



Hamilton precision hole-drilling machine, called "Maxi Jr."

Aircraft riveting hammer for driving Rollpin fasteners



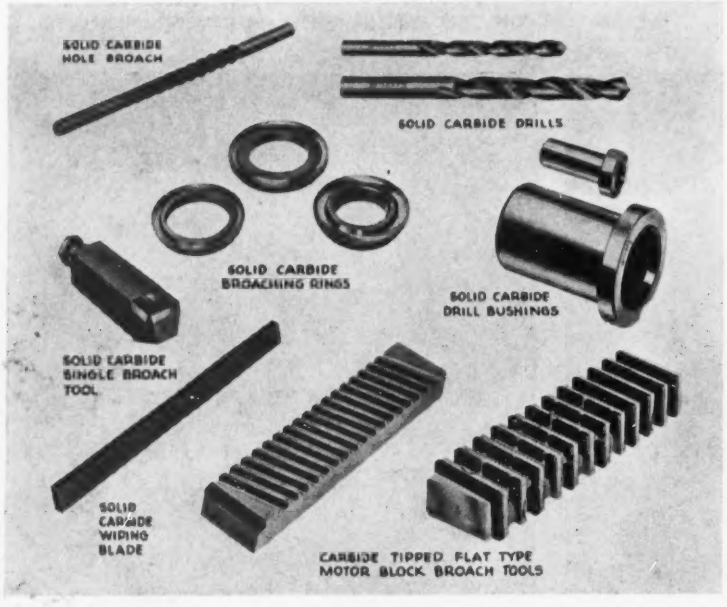
Rotary type tool and die table made by Advance Products

Rollpin Driving Power Tool

With the cooperation of Ingersoll-Rand, the Elastic Stop Nut Corporation of America, Union, N. J., has developed a power-tool driving set for faster insertion of its Rollpin fasteners. The set can be used with Ingersoll-Rand standard pneumatic aircraft riveting hammers Nos. AVC-10 to AVC-13. To start a pin, it is held in a slot in the edge of the driving anvil. Driving may then be performed by the face of the anvil. A raised stud on the face is used when the pin is to be countersunk. The hammer has a sensitive throttle control, permitting the pin to be started with light blows at slow speed. A regulator controls maximum power output to suit the requirements of the particular pin size and work material. 140

Rotary Table for Milling Machines

A rotary table for tool and die work having integral coordinate slides is being placed on the market by Advance Products, Benton Harbor, Mich. Work is clamped on the top slide, which is 11 inches square. Both slides can be adjusted rapidly to position work for cutting any radius having a center within an 8-inch square area over the table center. Stops are provided so that standard gage-blocks can be used for extremely precise work. Radii can be of any size within the limits of the milling machine table movement. The attachment table is rotated by a worm-shaft handwheel, the collar of which is graduated in minutes. This shaft can be quickly disengaged, allowing the table to be rotated freely by hand as an aid in locating the work. Rotational stops are also provided. 141


SOLID CARBIDE HOLE BROACH
SOLID CARBIDE DRILLS
SOLID CARBIDE BROACHING RINGS
SOLID CARBIDE DRILL BUSHINGS
SOLID CARBIDE SINGLE BROACH TOOL
SOLID CARBIDE WIPING BLADE
CARBIDE TIPPED FLAT TYPE MOTOR BLOCK BROACH TOOLS

Tungsten-carbide tools and products introduced at the recent A.S.T.E. Show by the Willey's Carbide Tool Co.

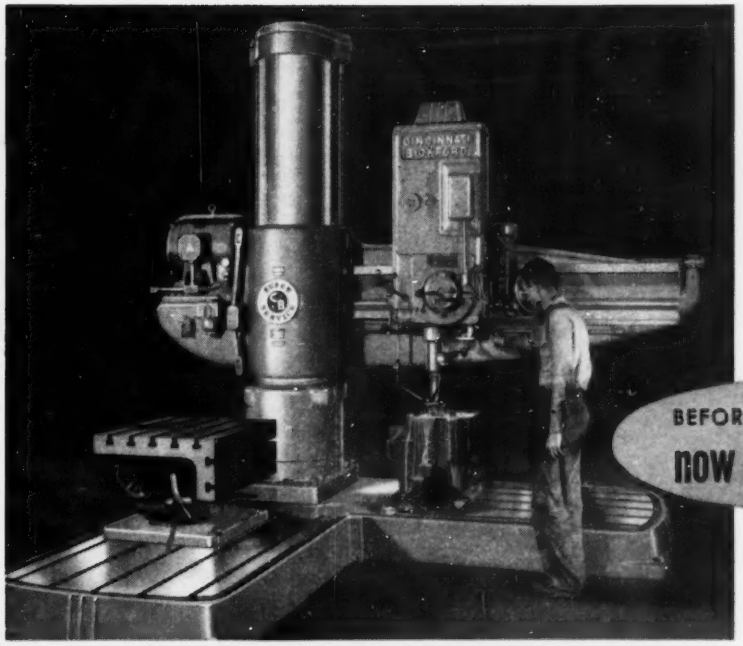
Willey's Tungsten-Carbide Tools

Willey's Carbide Tool Co., Detroit, Mich., has recently brought out a variety of tungsten-carbide tool products. Included are carbide-tipped flat broaches for machining cylinder blocks, cylinder block bearing adapters, and cylinder heads; and carbide-tipped single broaching tools for multiple and varied broaching operations. Also, solid-carbide tools and bushings, such as those shown in the accompanying illustration, are now available.

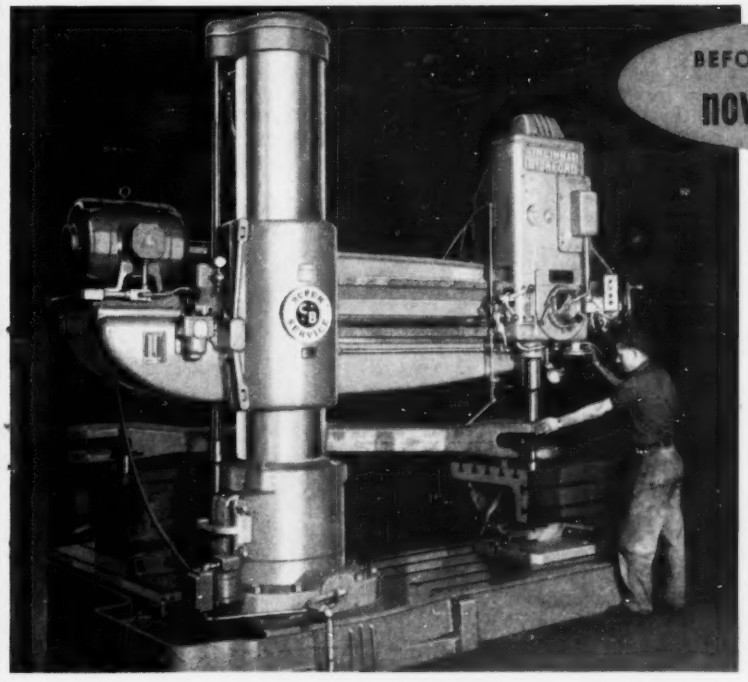
Solid tungsten-carbide drills in wire, fractional and letter sizes are other additions to the company's line, together with solid tungsten-carbide headless, head, fixed, and slip-renewable drill bushings that cover a range of sizes from 1/4 inch to 3 1/2 inches in diameter. 142

For more information on these products, use Inquiry Card, page 247

BICKFORD cuts floor to floor time!



BEFORE 38 MINUTES
now 23 minutes



BEFORE 5 HOURS
now 3 hours

These two jobs are done with time savings at the Ohio Steel Foundry Company of Lima, Ohio.

The machine (upper illustration) is drilling breech rings for guns from 76MM to the 155MM size. In this tough material a 2½" diameter lead hole is drilled and opened up to a 3½" diameter with a core drill.

Machine, below, is drilling 3 5/16" lead holes in a 9-foot Ladle Vale. Holes are opened up with a single point boring tool. Time savings result from the outstanding ease of control, and the power and rigidity of Super Service Radial Drills.

For power, accuracy, easy handling, check on Cincinnati Super Service Radial Drills.

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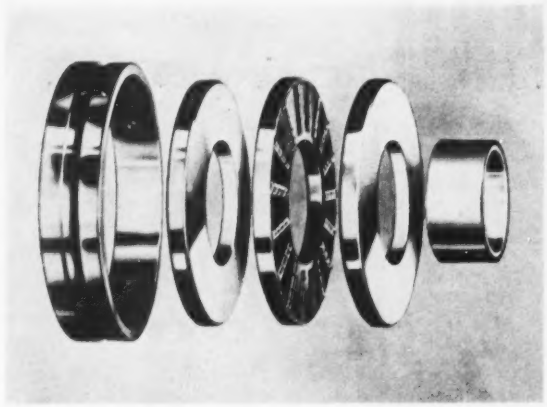


Improved thrust bearing announced by Rollway Bearing Co.

Swanson turret indexing unit equipped with clutch

Thrust Roller Bearing for Worm-Gears

The Rollway Bearing Co. Inc., Syracuse, N. Y., a subsidiary of the Lipe-Rollway Corporation, has announced a change in its Type SDT thrust roller bearings. These bearings will now have a one-piece high tensile strength sleeve of cast iron in place of the steel inner spacer sleeve with bronze inserts previously used. In addition to providing a good wearing surface, the new sleeve eliminates the possibility of an insert becoming loose due to heat.

This bearing is especially adapted for use with worm-gears and other applications where the direction of the thrust is frequently reversed. It is available in sizes having inner sleeve bores ranging from 1 inch to 11 inches in diameter; outside sleeves with diameters from 3.375 to 25.500 inches in diameter; and sleeve widths from 0.822 inch to 4.515 inches. Rated load capacities at 10 R.P.M. are from 10,750 to 1,170,000 pounds. 143

Manchester Squaring Shears

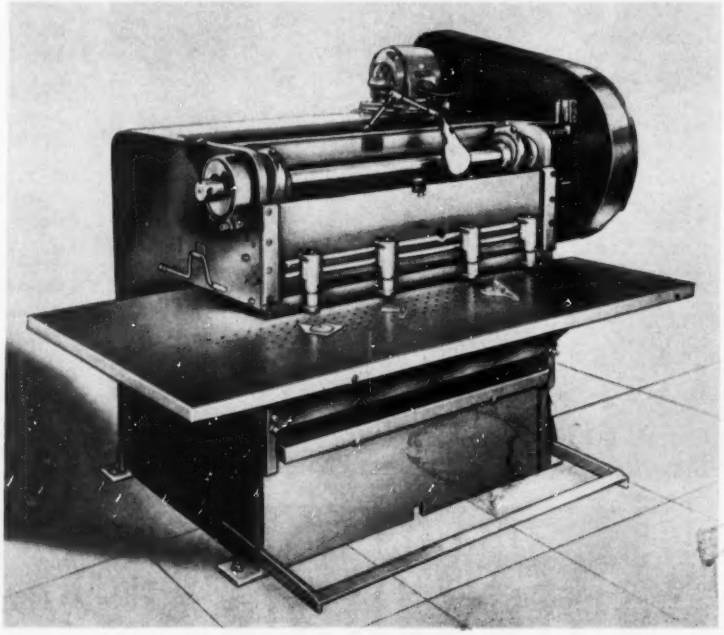
Squaring shears having a patented slide assembly that counteracts the rearward thrust of the blade are now being built by the Manchester Machine Corporation, Manchester, Conn. Other features of the machines are a deep, open throat that permits the use of the blade for notching, Micarta pads on material hold-down plungers, and an over-size table with holes for protractor guides. Two models are available, with cut-off capacities of 16 and 52 inches. 144

Clutch-Operated Turret Indexing Unit

Dwell periods ranging from 0.835 second to infinity are possible with the new clutch-operated series of turret indexing units now being offered by Swanson Tool & Machine Products, Inc., Erie, Pa. These units have been developed to supplement the Swanson direct-drive turret indexing units, and are available with eight, sixteen, twenty-four, or thirty-two work stations and 20-, 30-, or 40-inch turret diameters. Maximum indexes per hour range up to 2154.

The solenoid-operated clutch drive is especially suited to applications that require a variable work cycle, or where it is desirable to have the operator determine the indexing cycle by means of push-button controls.

When drilling cycles and other similar operational procedures require automatic control, limit switches may be used to prevent indexing before any given operation is completed. Harmonious indexing and accurate positioning at all work stations are assured by a cross-over cam and locking device. A "packaged" intermittent motion device can be provided for the indexing unit, saving cost of special machines. 145



Manchester squaring shear having a cut-off capacity of 52 inches

For more information on these products, use Inquiry Card, page 247

PEERLESS

ENGINEERING EXCELLENCE

that does the Never-Before

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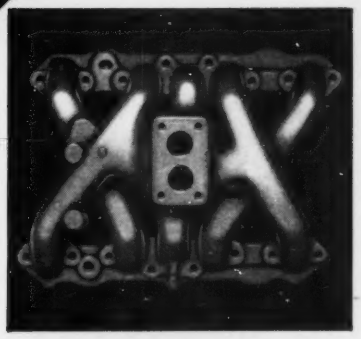
like this short Transfer with Overhead Return Conveyor— created to do a tough job in minimum floor area!



Part and Production: Intake Manifold for a new leading V-8 Engine. 180 pieces per hour at 100% efficiency.

Type of Specialized Production Equipment: 6-Station Automatic In-Line Transfer-Type Drilling-and-Tapping Machine with Automatic Overhead Pallet Return.

Tooling: Single-Place Pallet-Type Fixture with Manual Clamping. Anti-friction Drill and Individual Lead-Screw Tapping Heads.

BEFORE this PEERLESS, Plant Engineers were told that it was impossible to make a Transfer Machine which could be installed in such a small floor area.

NOW this PEERLESS, with specially-designed Overhead Pallet-Return Mechanism, is doing the job—setting a new high in maximum use of floor space!

Built to process all angular and bastard holes on Intake Manifolds, this PEERLESS was engineered for great flexibility—

Flexibility to take care of engineering changes if motor parts are altered.

Isn't this the kind of Engineering Excellence you want for your Specialized Production Equipment?

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PEERLESS

SPECIALIZED PRODUCTION EQUIPMENT

Counterbores and spot-faces made by Union Twist Drill Co.

Counterbores and Spot-Facers

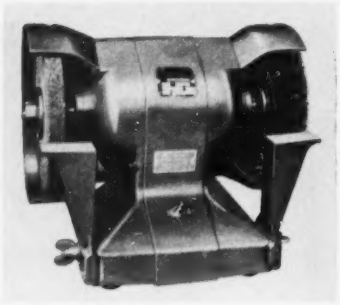
High-speed steel counterbores and spot-facers with interchangeable pilots have recently been added to the regular line of metal-cutting tools manufactured by the Union Twist Drill Co., Athol, Mass. Standard counterbores and spot-facers are being manufactured in long and short sets in both straight and taper shank styles. Also, two additional styles, a long and a short set with 1/4-inch shanks, are made especially for the aircraft industry. These styles are designed for use with portable equipment such as hand drills.

To insure rigidity and permanent alignment, all styles are made with the cutter and shank integral and with the cutting edges well backed. 146

Black & Decker Bench Grinder

A 1/4-H.P. 6-inch standard ball-bearing bench grinder has just been added to the regular line of 6-, 8-, and 10-inch bench grinders made by the Black & Decker Mfg. Co., Towson, Md. This new grinder is designed for intermittent shop use in general grinding, tool sharpening, wire brushing, and buffing. Features include a spindle mounted on permanent, lubricant-sealed ball bearings and two adjustable tool-rests. As the wheels become worn, the tool-rests can be moved closer to the wheels.

The grinder is nearly 9 inches high, weighs 25 pounds, and has an over-all spindle length of 12 inches. It uses wheels 6 inches in diameter, with a 5/8-inch face and a 1/2-inch spindle hole. The motor operates on alternating current, single-phase voltages. The grinder is made for 60-, 50-, or 25-cycle operation, with ratings of 3600, 3000, or 1500 R.P.M. at either 115 or 220 volts. 147



Black & Decker bench grinder

Beaver Quick-Change Holder—Correction

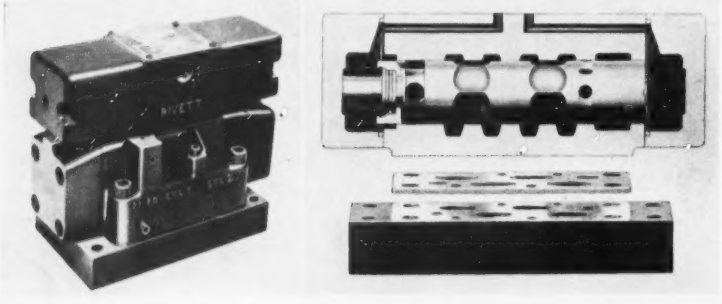
In the description of a Beaver quick-change holder that appeared on page 215 of April MACHINERY, an explanation of the design of machine tool spindles was inadvertently inserted in place of the following description of the tool-holder, a product of the Beaver Tool & Engineering Corporation, Royal Oak, Mich.

Beaver quick-change holder for Nos. 5 and 6 Morse spindles

The Beaver quick-change holder with Morse taper shank and adjustable keeper key slot has been developed to fit practically any No. 5 or 6 Morse taper spindle, whether on an American or foreign made machine. On this holder, the adapter plug that makes the adjustment possible is manufactured of high quality oil-hardening steel and heat-treated to a hardness that will resist wear from the action of the keeper key. The adapter plug has a precision ground taper to match the Morse taper shank. Shifting of the plug is prevented by the precision fit in the socket of the spindle. . . 149

Shock-Resistant Gasket-Mounted Valve

A gasket-mounted, solenoid-operated, four-way valve, said to be fully shock-resistant, has been developed by Rivett Lathe & Grinder, Inc., Boston, Mass. Impact and shock are eliminated by using a valve spool of scalloped design, which opens or closes gradually, increasing or decreasing the port areas as the spool is moved to the left or right. This Series 6600 valve is designed for pressures of 3000 pounds per square inch oil-hydraulic service. It meets all J.I.C. requirements. Two basic valves can be used for five sizes by merely changing the pipe tap size. The 1-inch valve may be used for 1/2-, 3/4-, or 1-inch pipe; and the 1 1/2-inch valve for 1 1/4 and 1 1/2-inch pipe. 148



(Left) Rivett gasket-mounted solenoid pilot-operated hydraulic valve; and (right) cross-sectional view of valve

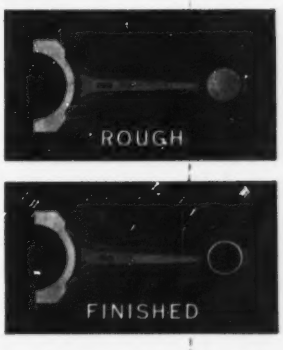
(*This section continued on page* 270)

For more information on these products, use Inquiry Card, page 247

Buhr SPECIAL...

Drills, reams and chamfers 565 Connecting Rods an hour

This Two-Column Automatic Drilling Machine
is arranged with tool-steel, laminated, hardened and ground ways.
Heavy-duty ball-bearing construction provided for all spindles.
The eight-station holding fixture is mounted
on 60″-diameter automatic Index Table.
Parts are manually loaded, hydraulically clamped and automatically ejected.
All installations comply with J.I.C. Standards.
Automatic lubrication throughout Machine.
Special safety features . . . Only one operator required.



BUHR MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

Buhr **MULTIPLE-SPINDLE HIGH PRODUCTION MACHINERY**

universally acclaimed! the *New* CP universal electric impact wrench

Here's a Universal Electric Impact Wrench that can really get itself into tight spots! And its powerful impact action, developing 2,000 blows per minute, runs nuts and screws or drills and taps easier, faster and with far less effort! It's the speedy ⅜" bolt size capacity CP-903R with its bonus capacity rating of ⅝".

Purposely designed with a slim profile for those awkward spot jobs, the wrench's nose section measures only 2" in diameter. Handy snap switch on the handle prevents reversing while wrench is running . . . affords simple one-hand operation. Pistol grip handle is centered at exact point of balance for effortless handling. And the CP motor is "unitized" for vibration resistance . . . affords long, maintenance-free service life. Write *Chicago Pneumatic Tool Company, 8 E. 44th St., N. Y. 17, N. Y.*

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

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NEW CATALOGUES

MACHINE TOOL SPINDLE BEARINGS—United Motors Service, Division of General Motors Corporation, Detroit, Mich. 33-page manual outlining the principles involved in the maintenance of machine tool spindles for doing high precision work. Illustrated step by step are the dismounting and assembly of ten typical ball-bearing supported spindles. This manual can be obtained from United Motors industrial distributors of New Departure bearings.

HEAT-TREATING ALUMINUM—Reynolds Metals Co., 2500 S. Third St., Louisville 1, Ky., 119-page manual entitled "Heat-Treating Aluminum Alloys," presenting in Section 1 the underlying principles having to do with the metallurgy and heat-treatment of aluminum and its alloys; in Section 2, metallurgical details; and in Section 3, tabular data. This book can be obtained upon company letterhead request direct to the above address.

ALLOY STEELS—Climax Molybdenum Co., 500 Fifth Ave., New York 36, N. Y. Book entitled "Alloy Steels Pay off," containing 207 pages of case histories showing how the adoption of alloy steels has saved money for the producer or user. Each case history is divided into two parts; the problem and the pay-off. Available upon business letterhead request direct to the above address.

TRI-BIT CUTTING TOOLS—Weddell Tools, Inc., 37 Centennial St., Rochester 11, N. Y. Catalogue 53, describing Weddell Tri-Bit metal-cutting tools. Can be obtained on company letterhead request direct to the above address.

BIRDSBORO FACILITIES—Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. 17-page booklet, 12 1/2 by 14 inches in size, pictorially outlining the company's facilities for producing a variety of products—as large as an 8000-ton hydraulic press and as small as a 3 1/2-pound fulcrum. Users of steel mill equipment, hydraulic machinery, jaw crushers, and steel castings will be interested in seeing how Birdsboro meets specific requirements. 1

AIR COMPRESSOR LUBRICATION—Cities Service Oil Co., New York City. 39-page manual showing how lubricants affect compressor operations, and how to benefit from their use. Information is also given about the grade and type required for maximum efficiency. Operating hints are included, as well as an appendix containing commonly used conversion factors, a thermometer conversion table; and an air reaction chart. 2

PNEUMATIC DIMENSIONAL GAGING—Sheffield Corporation, Dayton, Ohio. 24-page paper entitled "A Review of Pneumatic Dimensional Gages," which was presented by the author, Louis Polk, at the International Conference of Engineering Dimensional Metrology. Considered in some detail are types of pneumatic gaging circuits; gaging elements; measuring instruments; multiple gaging instruments; automatic gages; and machine tool application. 3

UNLOADING MACHINES FOR PRESSES—Sahlin Engineering Co., Birmingham, Mich. Booklet describing and illustrating various designs of Iron Hand automatic unloading machines for presses. Swinging arm and floor type machines are included, as well as six designs of special-purpose gripping jaws. Also, Catalogue 10, containing operating instructions and parts list for Sahlin Iron Hand unloading machines. 4

MILLING CUTTERS—National Twist Drill & Tool Co., Rochester, Mich. 39-page pamphlet entitled "Milling Cutters— Design, Application, and Maintenance." This report, which was published by the Milling Cutter Division of the Metal Cutting Tool Institute, is intended to serve as a guide to industry in properly applying the many available tool materials with respect to correct design, use, and care of milling cutters. 5

MOTOR MOUNTING DIMENSIONS—Reliance Electric & Engineering Co., Cleveland, Ohio. "Compar-A-Frame" chart to aid engineers and designers in quickly comparing the mounting dimensions of old and new NEMA standard motor frames. The chart is expected to be useful during the interim period when both open type and fan-cooled type polyphase induction motors are being used. . . . 6

AUTOMATIC CHUCKING MACHINE—Potter & Johnston Co., Pawtucket, R. I. Bulletin 123, descriptive of three additions to the P & J 5-D Power-Flex line: two-spindle 9-, 12-, and 15-inch automatic chucking machines. These machines are intended to meet production requirements when manufacturing operations necessitate an output in excess of that to be secured from a single spindle unit. 7

CENTRALIZED LUBRICATING SYSTEMS—Farval Corporation, Cleveland, Ohio. Bulletin 26, describing and illustrating Farval centralized systems of lubrication, which provide a mechanical method of dispensing measured quantities of oil or grease under pressure to a group of bearings from one central station as often as needed. Illustrated are applications of the system throughout industry. 8

SILENT CHAIN DRIVES—Link-Belt Co., Chicago, Ill. Book 2425, 88 pages of detailed engineering data on silent chain drives. The contents include features and advantages of Link-Belt silent chain drives; types of silent chain and silent chain wheels; A.S.A. stock drives; drive engineering, components, and accessories; and operational and technical data. . . 9

INVERTED HYDRAULIC PRESSES—Walter P. Hill, Inc., Detroit, Mich. Leaflet descriptive of the Hill line of inverted hydraulic presses adapted to bending and extruding operations on ferrous and nonferrous tubular parts, as well as upsetting,

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drawing, and coining operations that would require special equipment on standard presses. **10**

UNITED STATES STEEL MOTION PICTURES—United States Steel Corporation, Pittsburgh, Pa. Catalogue listing available industrial motion pictures prepared by the Corporation, and telling how they can be obtained. Several titles are "The Making and Shaping of Steel," "Steel . . . Man's Servant," and "Walls without Welds." **11**

CAST BRONZE AND COPPER PRODUCTS—National Bearing Division, American Brake Shoe Co., St. Louis, Mo. Booklet entitled "Cast Bronze and Copper Products for General Industry," illustrating the Division's manufacturing facilities and showing examples of bearings and castings. An NBD alloy chart and a guide for casting applications are given. **12**

BACK-STAND IDLER—The Carborundum Company, Niagara Falls, N. Y. Folder descriptive of the "61" universal back-stand idler, a low-cost attachment for all types of coated abrasive back-stand grinding and polishing operations. The idler is available in two models—Model 432 for floor-stand operations; and 431, for floor wall, or bench installation. **13**

BAKELITE POLYETHYLENE—Bakelite Co., a Division of Union Carbide and Carbon Corporation, New York City. Folder GA, giving technical information about molding, extruding, and other ways to use Bakelite polyethylene. Three tables list properties of various Bakelite polyethylene resins available in commercial and experimental quantities. **14**

THERMALLY SENSITIVE RESISTORS—Carboloy Department of General Electric Co., Detroit, Mich. Manual TH-13, consisting of 52 pages of information on Carboloy Thermistors—what they are, how they are applied, and some of the functions they perform, such as measuring and controlling temperature, and regulating voltage. **15**

HEAVY-DUTY ROLLER BEARINGS—Link-Belt Co., Chicago, Ill. Book 2565, describing new heavy-duty roller bearings designed for severe operating conditions found in steel mills, mines, and foundries. These Link-Belt "mill bearings" are made in shaft sizes from 2 7/16 to 6 15/16 inches in diameter. **16**

HYDRAULIC TUBE BENDING PRESS—Pines Engineering Co., Inc., Aurora, Ill. Bulletin describing the mechanical features and operating advantages of the new Pines 20-ton hydraulic bending press which handles pipe and tube sizes up to 2 inches in outside diameter by 0.083-inch wall thickness. **17**

HEAVY-DUTY SPINDLES—Whitnon Mfg. Co., New Britain, Conn. Catalogue describing unusual applications of Whitnon spindles on, for example, Brown & Sharpe universal grinders and the Nos. 2 and 5 surface grinders; Cincinnati universal internal grinders; and the Norton No. 1 tool and cutter grinder. **18**

BURNISHING MACHINES—Carl Hirschmann Co., Inc., Manhasset, N. Y. Booklet describing Swiss burnishing or pivot polishing machines, showing how work hardening, minute shaving, and polishing are combined in a single operation. . . . **19**

DRILL JIG BUSHINGS—Ex-Cell-O Corporation, Detroit, Mich. Catalogue containing an extended list of drill jig bushings. Drill size ranges have been increased and new lengths added to the four groups of renewable bushings and liners. A conversion chart is included. **20**

WATER-MIX CUTTING AND GRINDING FLUIDS—D. A. Stuart Oil Co., Ltd., Chicago, Ill. Booklet on four different water-mix cutting and grinding fluids. Various types of water mixtures are considered and factors in proper selection and application are discussed. **21**

MACHINABILITY OF LEADED STEEL AND FREE-CUTTING BRASS—Titan Metal Mfg. Co., Bellefonte, Pa. 48-page booklet entitled "First Report: The Machining Characteristics of Leaded Steel and Free-Cutting Brass," comparing laboratory and production tests of the two commercial metals. **22**

HORIZONTAL SHAVING MACHINES—National Broach & Machine Co., Detroit, Mich. Catalogue S-54-2, featuring Red Ring machines for the horizontal shaving of large external gears. Concise operating descriptions and application information are included for four models. **23**

FEEDING EQUIPMENT FOR PUNCH PRESSES—Wittek Mfg. Co., Chicago, Ill. Leaflet PFE-354, illustrating and describing the company's production feeding equipment for punch presses—automatic roll feeds, stock straighteners, and reel stands. **24**

FORGING FACILITIES—American Car & Foundry Co., New York City. 25-page booklet entitled "Forging Ahead with A.C.F." being the story of the company's industrial forging service. Illustrated are some of the forging facilities, at work, as well as examples of completed work. **25**

DRILLING AND TAPPING MACHINES—Edlund Machinery Co., Cortland, N. Y. Bulletin 150, describing in detail the improved Model M.S. motor-spindle drilling and tapping machines—one model for general production and toolroom use and another model for heavy work. **26**

LATHES—Axelson Mfg. Co. Division, Pressed Steel Car Co., Inc., Los Angeles, Calif. 36-page booklet featuring the methods and procedures behind the production of Axelson heavy-duty precision lathes. Also, a catalogue on Axelson lathes is available. **27**

REBUILDING STAMPING PRESSES—Verson Allsteel Press Co., Chicago, Ill. Bulletin R-49 entitled "New Life for Worn Out or Damaged Presses," outlining the company's rebuilding facilities and showing examples of typical press-rebuilding jobs. **28**

ACCESSORIES FOR BLAST-CLEANING—Pangborn Corporation, Hagerstown, Md. Bulletin 300C, describing the accessories and supplies that are available for use with Pangborn blast-cleaning equipment. Included are engineering selection data as well as specifications. **29**

HEAVY-DUTY TURRET LATHES—Warner & Swasey Co., Cleveland, Ohio. Booklet explaining the new design features of Warner & Swasey universal heavy-duty turret lathes which have been improved in order to cut production time and increase profits. **30**

SOLENOID-OPERATED TOOLS—Black & Webster, Inc., Newton, Mass. Catalogue containing descriptions of the company's solenoid-operated production tools—the Electropunch, Electrostake, and Electropress. Typical applications are shown. **31**

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POWER TRANSMISSION EQUIPMENT—Lovejoy Flexible Coupling Co., Chicago, Ill. 24-page catalogue on Lovejoy power transmission equipment—variable-speed pulleys, wide V-belts, sheaves, motor bases, countershafts, and Select-O-Speed transmissions. **32**

CUT-OFF BLADES—American Cam Co., Inc., Hartford, Conn. Form 154-B, descriptive of Amcam-X cast-alloy cut-off blades made to fit standard holders. This special alloy permits the use of high speeds and feeds on automatic screw machines. **33**

THREADING MACHINES—Landis Machine Co., Waynesboro, Pa. Booklet H-45-1, covering the new 32C and 48C Landmaco threading machines designed for the heavy-duty threading of large-diameter work-pieces. Design features are explained. **34**

BENCH MILLERS—U. S.-Burke Machine Tool Division, Cincinnati Mfg. Corporation, Cincinnati, Ohio. Folder descriptive of two power feed and two hand feed models of Burke bench millers for milling, drilling, boring, and other operations on small parts. **35**

ENGINE LATHES—Boye & Emmes Machine Tool Co., Cincinnati, Ohio. Bulletin CB53 on the company's medium-duty engine lathe; Bulletin BB53 on a 16-inch heavy-duty engine lathe; and Bulletin AB53, on a 14-inch heavy-duty engine lathe. **36**

MODERNIZING ELECTRICAL SYSTEMS—Westinghouse Electric Corporation, Pittsburgh, Pa. Booklet B-6133 entitled "Compete or Collapse," presenting the advantages of electrical modernization in industrial plants. **37**

HYDRAULIC PRESSES—Hydraulic Press Mfg. Co., Mount Gilead, Ohio. Bulletin 5401, showing pictorially nineteen different types of hydraulic presses and machines built by H-P-M, with brief summaries of their uses and sizes. **38**

MEASURING TOOL—George Scherr Co., Inc., New York City. Leaflet descriptive of a new model Mauser vernier caliper, intended for inside, outside, depth, and root measurements. This tool can be converted into a height gage as well. . . **39**

NYLON STOCK—Polymer Corporation of Pennsylvania, Reading, Pa. Leaflet on Polypenco nylon, Teflon, and Q-200.5 (Styrene Copolymer); and Nylatron (filled nylon). Characteristics, formulations, and available sizes are given. **40**

STRIP FEED PRESSES—Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio. Bulletin 1352, describing the No. 401 Hamilton strip feed press for the high-speed production of can ends, screw caps, and other light stampings. . . . **41**

DEVICE FOR LOCATING CENTERS—Black Drill Co., Inc., Cleveland, Ohio. Bulletin describing the Black "Centr-Finder" vise for locating centers or other predetermined points regardless of the shape of the work. **42**

POWER CHUCKING EQUIPMENT—S-P Mfg. Corporation, Cleveland, Ohio. Catalogue 105, featuring in 32 pages the company's self-centering power chucks, rotating air cylinders, air valves, and accessories. **43**

COOLANT FOR MACHINE TOOLS—Master Chemical Co., Toledo, Ohio. 44-

(Continued on next page)

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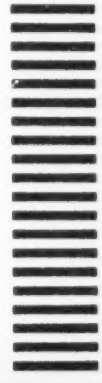

page booklet on cutting and grinding procedures using Trim, a cutting fluid for use in various machining and grinding operations. **44**

HYDRAULIC SURFACE GRINDERS—Thompson Grinder Co., Springfield, Ohio. Catalogue B-53, explaining the features of Thompson Type B hydraulic surface grinders. Included are clearance diagrams and charts. **45**

COMPACTING PRESS—Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. Bulletin 3104, describing a 50-ton compacting press for the low-cost fabrication of parts from metal powders. . . **46**

PILLAR PRESSES—Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. Folder 754-N.2, giving extensive details on the company's modernized line of multiple plunger pillar presses. . . **47**

CENTER MEASURING INSTRUMENTS—Sorensen Center-Mikes, Inc., Bridgeport, Conn. Bulletin descriptive of the company's bench type Center-Mike, which gives precise, quick center-to-center reading to 0.0005 inch. **48**

CUTTING OILS FOR TALIDE TOOLS—Metal Carbides Corporation, Youngstown, Ohio. Technical Bulletin TB-2 on lubricants and cutting oils recommended for use on Talide (tungsten-carbide) tools and dies. **49**

DIAL INDICATORS—Nilsson Gage Co., Inc., Poughkeepsie, N. Y. Bulletin 254 on the company's line of Nilcoid dial indicators, available in five models. The Nilcoid movement is described. **50**

CHAIN DRIVES—Ramsey Chain Co., Inc., Albany, N. Y. Catalogue 154, presenting the operating characteristics and service factors of Ramsey pre-selected chain drives. **51**

SPOT WELDERS—Federal Machine & Welder Co., Warren, Ohio. Bulletin RA-54 on Federal Type RA rocker arm spot welders, in which design features are explained. **52**

SMALL-HOLE TAPPING MACHINE—Hamilton Tool Co., Hamilton, Ohio. Bulletin T-54, featuring the Hamilton small-hole precision tapping machine and giving specifications. **53**

TOOLS FOR SCREW MACHINES—R and L Tools, Philadelphia, Pa. 30-page catalogue giving technical data on the company's line of right- and left-hand precision tools for screw machines. **54**

HIGH-ALLOY CASTINGS—Cooper Alloy Foundry Co., Hillside, N. J. Bulletin CC54, showing how the company produces stainless-steel spun rings for jet engines, specialty and aircraft castings. **55**

DROP FORGINGS—Billings & Spencer Co., Hartford, Conn. Booklet entitled "The Story of Drop Forgings and the Billings & Spencer Co.," showing how Billings drop forgings are made. . . **56**

PNEUMATIC DIE CUSHIONS—Dayton Rogers Mfg. Co., Minneapolis, Minn. Folder descriptive of the Model D universal pneumatic die cushions, which can be installed on any punch press. **57**

TAPS—Reiff & Nestor Co., Lykens, Pa. Catalogue 10, giving data on size, threads, flutes, and prices for R & N standard taps, as well as many special taps. **58**

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- **For Air and Other Service**
- **Parts Interchangeable with Other Ross Four Way, Base Mounted Valves**

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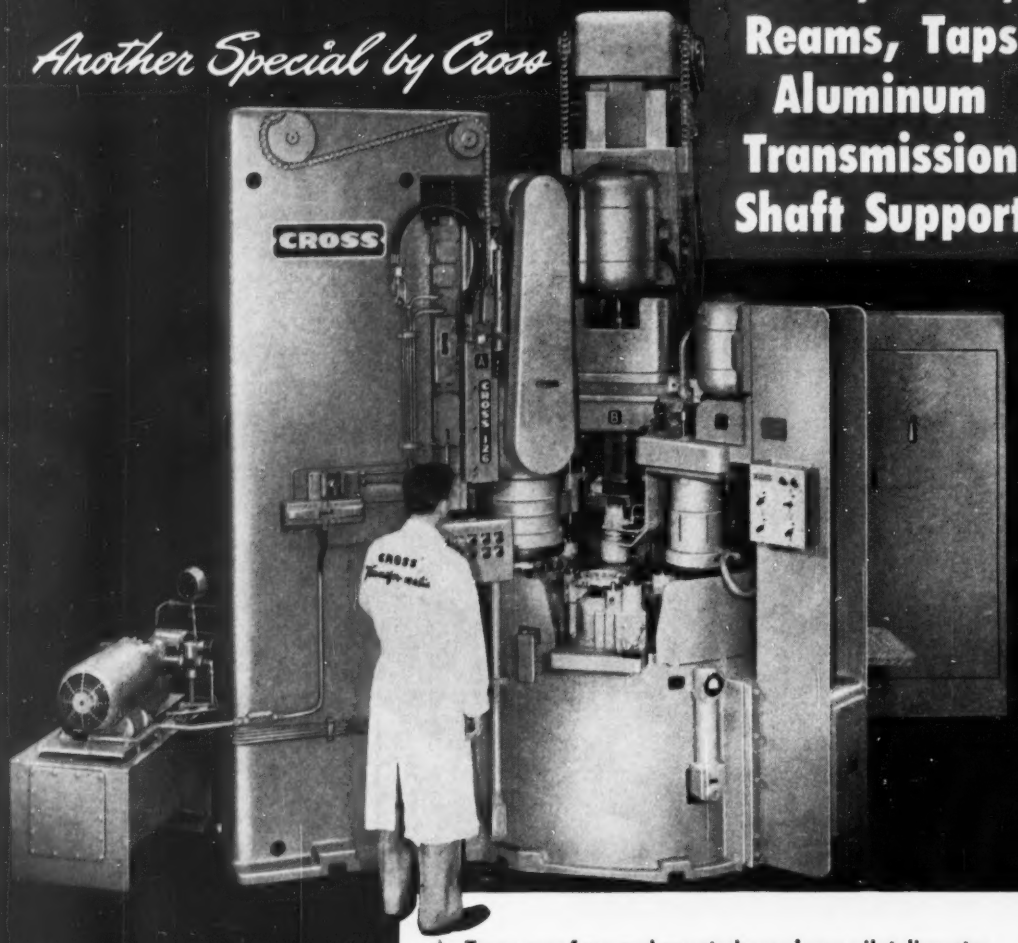
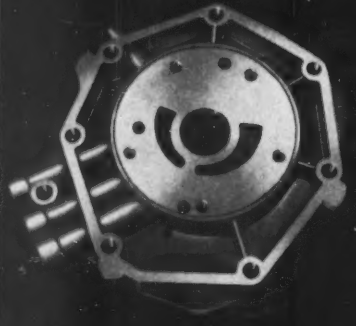
Bores, Drills, Reams, Taps Aluminum Transmission Shaft Support





- ★ Turns rear face and counterbores large pilot diameter, drills 6 holes, drills and reams 2 locating holes, chamfers and taps 5 holes.
- ★ 128 aluminum castings per hour at 100% efficiency.
- ★ 6 station fluid motor driven index table with 1 loading and 5 working stations.
- ★ Hydraulic power clamping for work holding fixtures.
- ★ Complete interchangeability of all standard and special parts for easy maintenance.
- ★ Other features: Hydraulic feed and rapid traverse; hardened and ground ways; filtered coolant system; construction to J.I.C. standards; automatic work cycle.

Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

For more information on products advertised, use Inquiry Card, page 247

Between Grinds

By E. S. Salichs

Pity the Pants

The duties of our Editor recently included sitting under a solar furnace at the Convair plant watching titanium being melted by the intense heat developed from the sun's rays, which are collected by a huge mirror. But while he sat innocently marveling at the effects of 8500 degrees F. through his protective goggles, his V.B. (very best) trousers were being peppered with four holes from titanium spatter.

Jest What Gesture?

A proofreader on our staff recently attended a party where the game of charades was suggested. Her team lost the first round to the opposing smarties and so were casting around for more difficult words or sayings to be acted out. Having been exposed to the Buckingham series of gaging articles running in MACHINERY since last May, our proofreader came up with *dimensional tolerances*. Stumped for an expressive way to act this one out, the opposing team went down on it.

Not Too Frail to Mail

Back in 1888, when the adventurous person purchased an Eastman Kodak camera, he found that it was already loaded. According to instructions, after taking his pictures he was to return the camera, not just the film, to Eastman. Then the camera was reloaded and returned to the photographer along with the developed film. This procedure accounts not only for the company's slogan—"You Push the Button; We Do the Rest"—but probably for the dilapidated look of museum-piece cameras.

• • •

Saving Face

This cow was intended to be a decorative motif (our own bright idea) tying in with the title of Bernard Lester's article "Getting Rid of Cows that Don't Pay," which appears on page 216 of this number. But the electro of the cow that was ordered did not arrive in time; the page was already printed. So here we were, literally trying to get rid of a cow that didn't pay (potential loss, $1.50). Our head unbowed, we made the decision: Elsie appears, relegated to the B.G. page.

LISA AND LYDIA IN LATHE LAND—Demonstrating the twin tray top feature of Cincinnati Lathe & Tool Co. lathes are twins Lisa and Lydia Fiesselman. The twin on the headstock is getting into action on what is probably the largest playtoy in her life; the twin on the tailstock is pleased with the prospect of the stops, levers, and chips surrounding her. But what happens when, the picture snapped, the twins discover they can't take the Cincinnati lathe home?

News OF THE INDUSTRY

California and Texas

J. ALLEN CARMIEN, executive vice-president of the New Plastic Corporation, manufacturer of Nupla soft-faced tools, Los Angeles, Calif., has become president, assuming the position formerly held by FRED S. JAHN, who resigned as president and director in March. JOHN W. SCHMIDT has been made sales manager of the Tool Division.

J. F. SCHIRTZINGER has been appointed president and general manager of the Consolidated Tool & Products Co., Los Angeles, Calif., suceeding the late ANTHONY OBERHOLTZ. Mr. Schirtzinger was formerly an engineering executive at the Consolidated Vultee Aircraft Corporation. T. N. BAKER has joined the company in the capacity of general sales manager.

TERRENCE H. M. TAYLOR has been named chief engineer at the Nordstrom Valve Division plant, Oakland, Calif., of the Rockwell Mfg. Co., Pittsburgh, Pa. Mr. Taylor was formerly a research scientist with the United States Atomic Energy Commission.

PAUL E. LAFRANCE has been named manager of the Los Angeles, Calif., office of the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa.

STRONGHOLD PACIFIC CORPORATION, Downey, Calif., announces that its name has been changed to the OLYMPIC SCREW & RIVET CORPORATION. S. R. MANESS is president.

LANCE MOSDELL has joined the Benchmaster Mfg. Co., Gardena, Calif., in the capacity of plant manager.

ROBERT J. BURNUP has been made a sales manager by the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. He will be located in the Houston, Tex., district office and will cover Louisiana and Texas.

DENVER EQUIPMENT CO., Denver, Colo., announces a new address for its El Paso, Tex., office—201 W. 7th St.

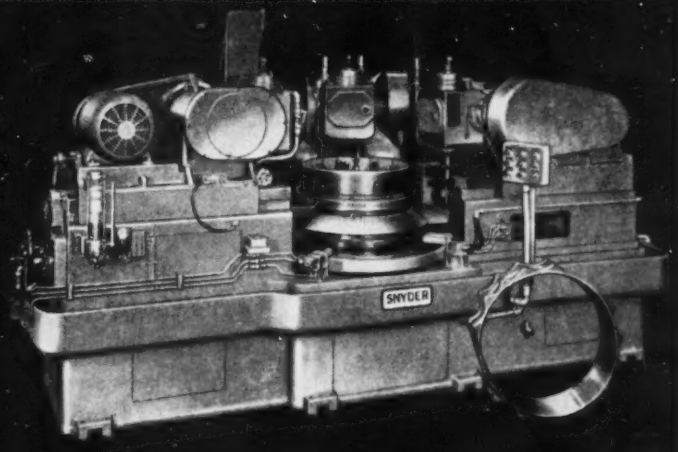
Connecticut and Massachusetts

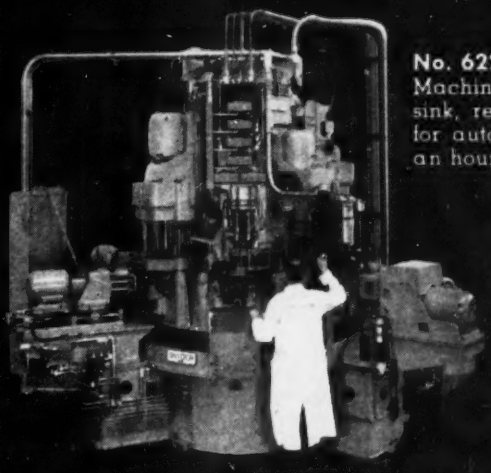
ALEXANDER H. D'ARCAMBAL has been elected president of Niles-Bement-Pond Co., West Hartford, Conn., which includes the Pratt & Whitney Machine Tools Division, Pratt & Whitney Cutting Tool and Gage Division, Chandler-Evans Division, and the Potter & Johnston Co., Pawtucket, R. I., a subsidiary. Mr. d'Arcambal has been acting general manager since the recent death of Frederick U. Conard. He has been with the company for thirty-five years, having started as a metallurgist in the Pratt & Whitney Division. In 1927, Mr. d'Arcambal was appointed sales manager of the Cutting Tool and Gage Division, and in 1947, was elected vice-president. In 1950, he assumed the additional responsibilities of general sales manager and became a director. Also announced at this time was the appointment of CHARLES W. DEEDS as chairman of the board of directors. Mr. Deeds is a former president of the company, his period of office having extended from 1943 to 1947. RICHARD W. BANFIELD was named to the newly created position of executive vice-president. He has been with the company since 1935. After holding various executive positions, he was elected a vice-president in 1953, and subsequently was named manager of the Pratt & Whitney Cutting Tool and Gage Division, a position which he continues to fill. Also announced was the election of SIDNEY A. STEWART as a vice-president of the Niles-Bement-Pond Co. and his appointment as chief executive officer of the Chandler-Evans division, with the title of manager. Mr. Stewart will assume this new post on June 1, having announced his resignation as executive vice-president of the Delta-C&S Air Lines.

LOUIS J. BAUDIS has been elected vice-president in charge of manufacturing and a director of the Bullard Co., Bridgeport, Conn. Mr. Baudis joined the company in 1935, and after several promotions became chief engineer in 1947. C. HAROLD ANDERSON, who was assistant chief engineer, has been promoted to the post of chief engineer formerly held by Mr. Baudis. Mr. Anderson joined

(Left to Right) Charles W. Deeds, chairman of the board of directors of the Niles-Bement-Pond Co.; Alexander H. d'Arcambal, company president; Richard W. Banfield, executive vice-president; and Sidney A. Stewart, a vice-president of Niles-Bement-Pond and manager of Chandler-Evans Division

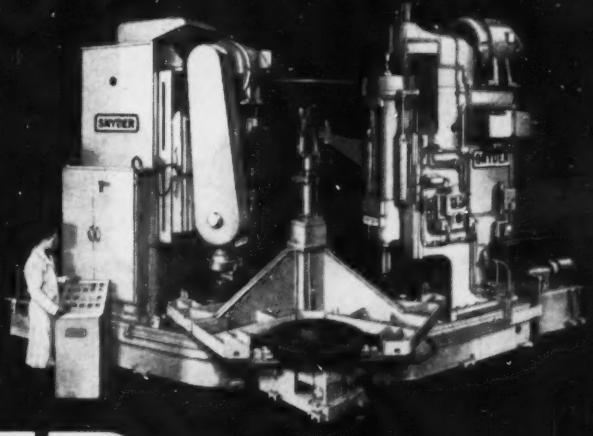
No. 68326—A three-way machine to profile mill four rows of lugs on a compressor casing for jet engines. 135 minutes are used to perform this operation in 3 steps.





No. 62207—Six Station Center Column Machine to drill, counterbore, countersink, ream and tap converter housing for automatic transmissions. 91 pieces an hour at 80% efficiency.

No. 67677—Two-Station, Vertical Column, Boring and Facing Machine to rough bore and face the hub of heavy railroad car wheels. Bore 6¼" x 7" long. 33 units an hour at 100% efficiency.



SPECIALS by SNYDER

TOOL & ENGINEERING COMPANY
3400 E. Lafayette, Detroit 7, Michigan

29 Years of Successful Cooperation with Leading American Industries

(Left) C. Harold Anderson, newly appointed chief engineer of the Bullard Co. (Right) Louis J. Baudis, vice-president in charge of manufacturing, and a director of the company

the company as a draftsman in 1920, became chief draftsman in 1949, and a year later, assistant chief engineer.

GEORGE BACKMAN has become manager and chief engineer of the Rolling Mill and Mill Machinery Division of the Waterbury Farrel & Machine Co., Waterbury, Conn. He succeeds IRVING H. TOLLES, who has retired. Also announced was the promotion of HARRY LANGE from assistant to chief engineer in charge of the Bolt, Nut, Screw & Rivet Machinery Division. This position was formerly held by JOSEPH M. SCHAEFFER, who recently became president of the company.

RALPH S. HOWE, executive vice-president of the New Britain Machine Co., New Britain, Conn., was recently promoted to the presidency, while ROBERT T. FRISBIE, who was president, has become chairman of the executive committee of the board of directors. JULIAN C. PEASE, a vice-president, will become executive vice-president and continue as general manager of the New Britain-Gridley Division. CLARENCE E. BACHMAN, general manager of the Precision Products Division, will become a vice-president in charge of the Division. GEORGE G. WILCOX, manager of the Hand Tool Division, will also become a vice-president in this Division.

Ralph S. Howe, president of the New Britain Machine Co.

M. W. EVANS has joined the Felters Co., Boston, Mass., and will be in charge of product development sales. H. S. LINES has become associated with the company in a consulting and advisory capacity on the development of new products.

CHARLES W. LEDIG has been appointed sales manager of the Industrial Actuators and Controls Division of the National Pneumatic Co., Inc., and Holtzer-Cabot Divisions, Boston, Mass.

ROBERT ABEL & CO., 112 Cypress St., Brookline, Mass., has been appointed agent for SR-4 crane scales in New England, with the exception of Connecticut, by the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa.

Illinois, Indiana, and Iowa

JACK F. ANSCHUETZ has been named assistant sales manager of the Clearing Machine Corporation, Chicago, Ill. In this capacity, he will be responsible for the sales of open-back inclinable presses and other press equipment now being manufactured at the company's Hamilton, Ohio, plant, which will be his headquarters. Mr. Anschuetz was formerly associated with Clearing's Chicago sales office. The concern has also announced new assignments for two sales representatives—ROBERT YOCUM, who was in the Indianapolis, Ind., territory, will be in charge of the Lansing, Mich., office; and JACK WEBER, who was affiliated with the Chicago sales office, will be in charge of press sales in the Indianapolis territory.

BARNES DRILL CO., Rockford, Ill., recently purchased a 30-acre site in the Loves Park area, and plans to build a $3,000,000 plant which will eventually house the machine tool firm's entire operation. There will be a gradual transfer from the company's present location at 814 Chestnut St., to the new one at Windsor Road. The new building will occupy approximately 300,000 square feet. The company produces a complete range of drilling and tapping machinery, special units and transfer machines, honing machines, and Kleen-All products, which include magnetic coolant separators and coolant filters.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., announces the following appointments in its marketing and public relations divisions, which have their headquarters in Chicago: KEITH J. EVANS, for many years advertising and sales promotion manager, has been made director of marketing and public relations; and LOWELL M. BENNETT, formerly in charge of sales promotion, has been appointed to the post Mr. Evans vacated. Also announced at this time was the appointment of JAMES M. HELME as director of industrial relations.

INGERSOLL MILLING MACHINE CO., Rockford, Ill., has appointed three men to its staff of cutter and cutter grinder sales representatives, and revised a few territorial assignments as follows: WALTER J. MASON, Indiana and western Ohio; ROBERT H. HARRIS, Philadelphia and New York metropolitan areas; DONALD G. BROPHY, eastern Ohio and western Pennsylvania; D. L. S. MCCOY, Detroit area; RALPH W. JENSEN, central Michigan.

WESLEY R. JOHNSON has been appointed eastern district manager of the Shakeproof Division of the Illinois Tool Works, Chicago, Ill. Headquarters of the division are in Elgin, Ill. Mr. Johnson was formerly sales representative for the New York area, this position now being filled by ROBERT S. CARROLL.

SEYMOUR WEINSTEIN has been appointed technical director of the Ni-

(*Continued on page* 261)

This 25-ton induction stirrer is fastened to the bottom of a 90-ton capacity electric arc furnace.
One of the coils for the stirrer, made of Revere rectangular copper tube. Coil is 12 feet long, over 6 feet wide.
Revere Copper
helps stir molten steel

When steel is produced in an electric arc furnace it is highly desirable to stir the molten metal, to assure uniform heat and avoid stratification of the various alloy constituents. Manual and mechanical methods have been used, but the most modern method is electrical—induction stirring. This is accomplished by sending low-frequency two-phase currents through copper coils immediately under the furnace. The magnetic field thus produced stirs the melt most effectively. Stirring can be reversed, and the contents of the furnace made to flow toward either the slag door or the pouring lip.

Because of the heavy currents required, copper's high electrical conductivity makes it essential. Since the stirring coils are close to the furnace, they must be water cooled, distilled water being used in a closed system. Copper's high thermal conductivity is vital here. The basic copper for the stirrers made by Elliott Company, Ridgway, Pa. for Aros Electric, Inc., New York, is Revere rectangular tube, .945" x .750", .157" wall. Elliott and Revere technical personnel worked closely on the problem of specifications, arriving at joint agreements on tolerances and temper suitable for bending. These proved successful from the start, again showing the value of close collaboration between Revere and its customers . . . If you have a problem in connection with copper and its alloys, and aluminum alloys, consult Revere. See the nearest Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

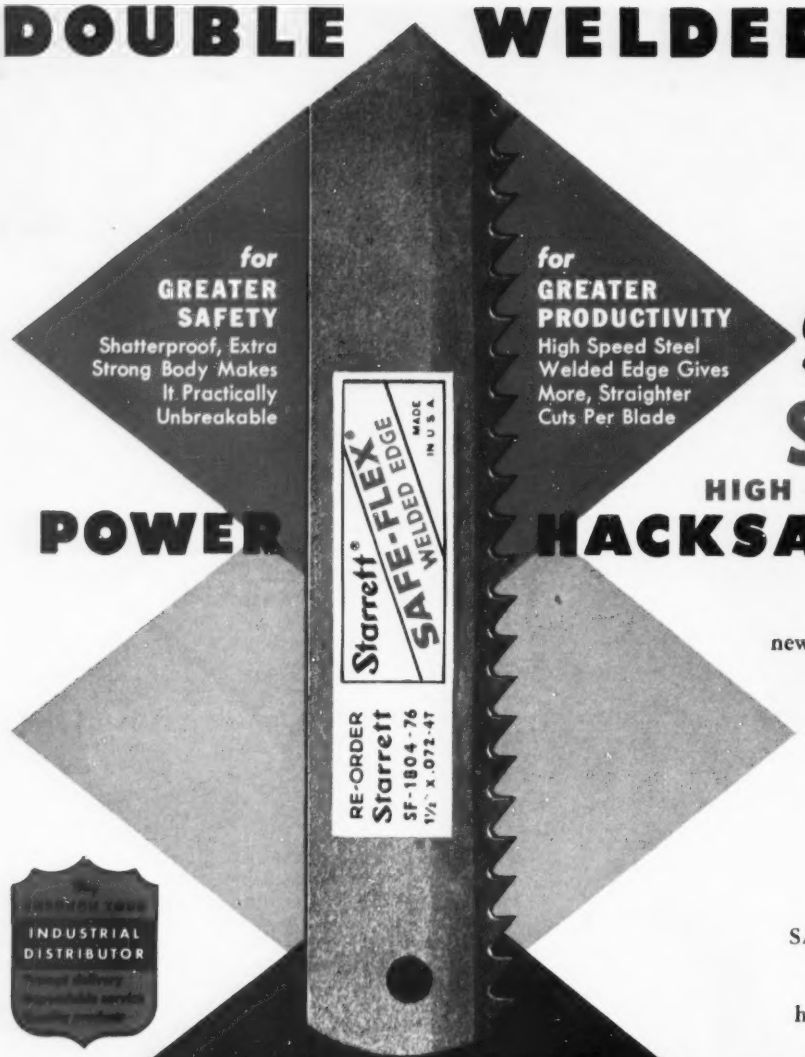
230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Rome and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.

Sales Offices in Principal Cities; Distributors Everywhere

"MEET THE PRESS" NBC TELEVISION, SUNDAYS

DOUBLE WELDED



Starrett® SAFE-FLEX
HIGH SPEED WELDED EDGE
POWER HACKSAW BLADES

Double welding makes this great new power blade the safest, straightest-cutting, longest-lasting hacksaw you can buy. Use it with complete safety for your toughest cutting jobs — for multiple sawing or interrupted cuts. Step up the feed and speed and watch it breeze through work that shatters ordinary blades.

Double welded construction as featured in these new Starrett SAFE-FLEX Power Blades gives you a cutting edge of hard high speed steel, reinforced with a medium-hard, extra strong center and backed up by a super-tough steel back. This ideal combination is integrally welded by modern methods to make a far stronger blade with a perfect balance of hardness and toughness.

Ask your safety engineer and production supervisors to look into this great new blade. Order some today through your Industrial Distributor.

Visit the
STARRET Exhibit
NATIONAL QUALITY
CONTROL CONVENTION
St. Louis, June 9 - 11

THERE IS A STARRETT HACKSAW BLADE FOR EVERY JOB — HAND AND POWER SIZES. FOR COMPLETE INFORMATION, WRITE FOR STARRETT HACKSAW CATALOG D

Starrett®

"WORLD'S GREATEST TOOLMAKERS"

STARRETT TOOLS

MECHANICS' HAND MEASURING
TOOLS AND PRECISION INSTRUMENTS · DIAL INDICATORS · STEEL TAPES
PRECISION GROUND FLAT STOCK · HACKSAWS, BAND SAWS and BAND KNIVES
THE L. S. STARRETT COMPANY, ATHOL, MASSACHUSETTS, U. S. A.

For more information on products advertised, use Inquiry Card, page 247

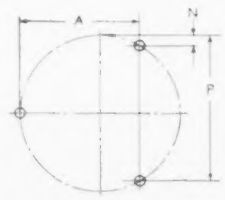
LAY-OUT CONSTANTS FOR BOLT CIRCLES — 1

Multiply Values Shown by Radius of Pitch Circle

MACHINERY'S Data Sheet No. 753, May, 1954

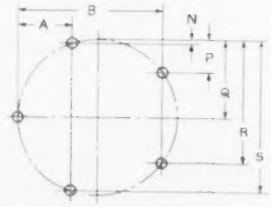
Compiled by W. G. Holmes
Minneapolis, Minn.

3 Holes



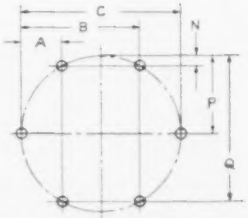
A = 1.5
N = 0.13397
P = 1.86603

5 Holes



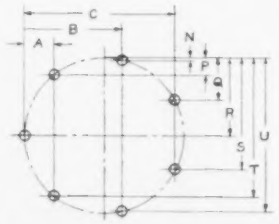
A = 0.69098
B = 1.80902
N = 0.04894
P = 0.41222
R = 1.58778
S = 1.95106

6 Holes



A = 0.5
B = 1.5
C = 2.
N = 0.13397
P = 1.
Q = 1.86603

7 Holes



A = 0.37653 N = 0.02508 S = 1.43382
B = 1.22257 P = 0.21815 T = 1.78185
C = 1.90093 Q = 0.56603 U = 1.97492

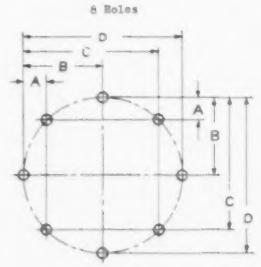
LAY-OUT CONSTANTS FOR BOLT CIRCLES — 2

Multiply Values Shown by Radius of Pitch Circle

MACHINERY'S Data Sheet No. 754, May, 1954

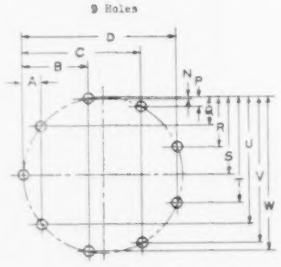
Compiled by W. G. Holmes
Minneapolis, Minn.

8 Holes



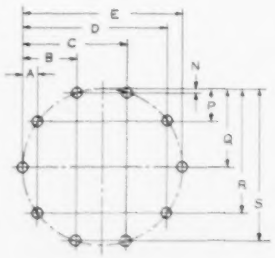
A = 0.29289
B = 1.
C = 1.70711
D = 2.

9 Holes



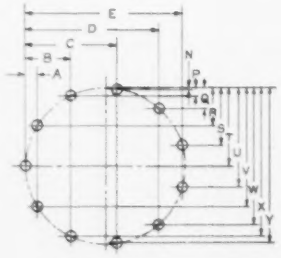
A = 0.23396 N = 0.01519 T = 1.34202
B = 0.82635 P = 0.13397 U = 1.64279
C = 1.5 Q = 0.35721 V = 1.86603
D = 1.93969 R = 0.65798 W = 1.98481

10 Holes



A = 0.19098 N = 0.04874
B = 0.69098 P = 0.41222
C = 1.30902 Q = 1.
D = 1.80902 R = 1.58779
E = 2. S = 1.95106

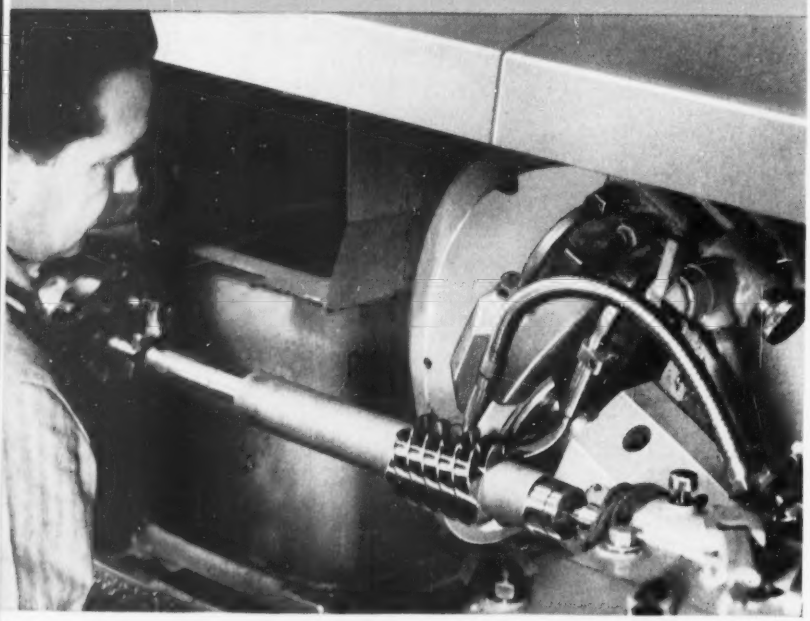
11 Holes



A = 0.15875 N = 0.01017 U = 1.28187
B = 0.58458 P = 0.09032 V = 1.54064
C = 1.14228 Q = 0.24426 W = 1.75574
D = 1.65488 R = 0.45936 X = 1.90967
E = 1.95951 S = 0.71833 Y = 1.98983

Grinding 5-Start Worm with 4" Lead

STANDARD STYLE 36 EX-CELL-O *Precision* THREAD GRINDER

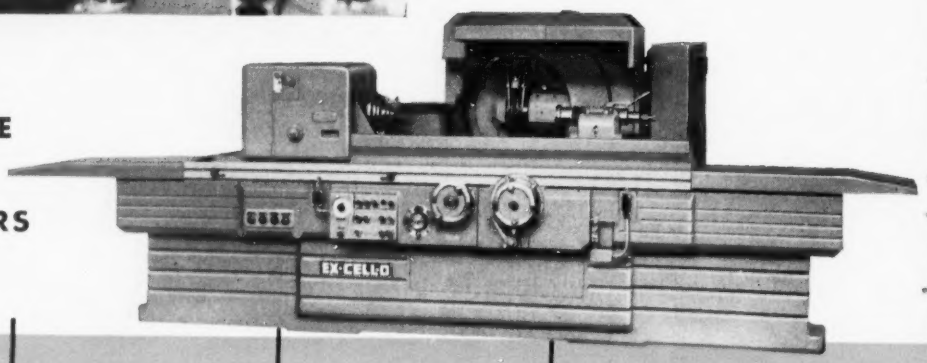


In the photograph at the left the operator is grinding a worm shaft for use in a special machine. The part is about 22" long and the worm is 4½" long, 3.430" O.D., has 5 starts, a pitch of .800", a lead of 4" and a tooth depth of .5454". The worm was ground in two operations on a standard Style 36 Thread Grinder. It was rough ground from the solid, hardened, then finish ground.

For complete information and specifications on the Style 36 and other Ex-Cell-O Thread Grinders contact your local representative or write today to Ex-Cell-O.

XLO

A COMPLETE LINE OF PRECISION THREAD GRINDERS



STYLE 50
Precision Thread Grinder—a versatile machine for external work, also available with internal attachment.

STYLE 33
Precision Thread Grinder—a high production machine for external work.

STYLE 39-A
Precision Thread Grinder—a high production machine for internal threads.

STYLE 36
Precision Thread Grinder—a versatile machine for extra long external threads, available with internal attachment.

EX-CELL-O CORPORATION • Detroit 32, Michigan

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

53-35

agara Filters Division, American Machine and Metals, Inc., East Moline, Ill. Mr. Weinstein was formerly central district sales manager for Niagara, with headquarters in Chicago. J. WALTER BIRD assumes this vacancy.

CRANE PACKING CO., Chicago, Ill., announces that new and enlarged high production facilities have been installed at its Morton Grove, Ill., plant to provide precision lapping service. The company manufactures Lapmaster lapping machines.

THOR POWER TOOL CO., Aurora, Ill., portable electric tools manufacturer, has purchased the SPEEDWAY MFG. CO., Chicago, Ill., manufacturer of lower priced craft type tools, which will be operated as the Speedway Mfg. Division.

SURFACE COMBUSTION CORPORATION, Toledo, Ohio, announces the removal of its Industrial Furnace Division from 122 S. Michigan Ave., Chicago, Ill., to the Park Ridge Federal Bank Bldg., 116 S. Prospect, Park Ridge, Ill.

OILGEAR CO., Milwaukee, Wis., has opened an office at 1404 N. Main St., Rockford, Ill., to serve western Illinois. MAURICE E. GRANT, district engineering representative in this area, will be in charge of the office.

CLECO PNEUMATIC TOOL DIVISION OF REED ROLLER BIT CO., Houston, Tex., has named LICHTENBERGER BROS. as distributors for Cleco air tools in Chicago, Ill. The distributors are located at 2715 W. Lake St., Chicago.

HARMON S. EBERHARD was recently elected president of the Caterpillar Tractor Co., Peoria, Ill., to succeed LOUIS B. NEUMILLER, who has become chairman of the board.

HERMAN A. GLEDHILL has been appointed general manager of the former Chapman-Price steel plant at Indianapolis, Ind., recently purchased by the Heppenstall Co., Pittsburgh, Pa. Mr. Gledhill was general superintendent of the company's Bridgeport, Conn., plant at the time of his appointment.

FAIRBANKS, MORSE & CO., Chicago, Ill., have announced the organization of an Electronics Division located at Davenport, Iowa. L. J. MAGUIRE has been appointed manager. He was formerly general manager of the St. Johnsbury, Vt., works of the company.

Michigan and Wisconsin

W. CURTIS MILLER and LELAND E. COULTER have become vice-presidents of the Allied Products Corporation, Detroit, Mich., while V. LEONARD HANNA has been named to the newly created office of controller. Mr. Miller, who has been with the corporation for eight years, will assume management of plant No. 3, at Hillsdale, Mich., assuming the vacancy created by the resignation of WALTER S. SMITH. JOHN GERGEL will become general manager of plant No. 4, the post that Mr. Miller held at the time of his promotion. Mr. Coulter, who has been with the Allied Products Corporation since 1936 (with the exception of four years when he was in the military service), will have his headquarters at a new plant under construction in Redford Township, which is outside the Detroit city limits. He will have complete charge of the RB and Hercules interchangeable punch and die activities.

EX-CELL-O CORPORATION, Detroit, Mich., has announced the formation of a subsidiary, EX-CELL-O CORPORATION (MACHINE TOOLS) LTD., to be located in England. The new subsidiary recently acquired ALFRED BRAY & SONS, LTD., of Leicester, England, and will begin to manufacture some of the machine tool lines now being produced by the parent corporation in the United States. E. J. TOWNSEND has been appointed managing director.

RALPH E. CROSS, executive vice-president of The Cross Company, Detroit, Mich., has been made Technical Advisor for the United States during overseas conferences on control of strategic materials. This is supplementary to his duties as Director of the Metal-Working Equipment Division, Business and Defense Services Administration, United States Department of Commerce.

CARBOLOY DEPARTMENT of General Electric Co., Detroit, Mich., announces the appointment of the following field sales representatives: ROBERT DRAKE, for the Atlantic district, Philadelphia, Pa.; JOSEPH C. BETTS, specializing in permanent magnets, for Michigan and Ohio with Detroit, Mich., as his headquarters; and ROBERT M. POZZO, for the Atlantic district at its headquarters, Newark, N. J.

JACK PETRUNO has been named factory engineer in the Detroit, Mich., office of the S. W. Card Mfg. Co., Mansfield, Mass., Division of Union Twist Drill Co. Since 1949, Mr. Petruno was a representative in northwestern Ohio for a cutting tool distributor, but in March became associated with S. W. Card.

P. M. M. SALES & ENGINEERING CO. is a new company organized to represent manufacturers in sales and distribution and to handle gear contracting and consulting work. Partners are C. M. PETER, JANUARIUS A. MULLEN, and JAMES MASON. The company is located in the Book Bldg., Detroit, Mich.

JAMES R. LONGWELL, assistant to the general manager of the Carboloy Department of General Electric Co., Detroit, Mich., has retired and has formed the Longwell Engineering-Sales Co., with offices at Birmingham, Mich. Mr. Longwell had been with Carboloy since 1929.

ARTHUR A. CONRAD, JR., a metallurgist, has joined the Detroit, Mich., Technical Section of the Development and Research Division of the International Nickel Co., Inc., New York City. Prior to this, he was chief metallurgist with Precision Metalsmiths, Inc., Cleveland, Ohio.

B. O'MEARA has been elected executive vice-president of the Gairing Tool Co., Detroit, Mich., while WILLIAM B. MCCLELLAN has been appointed sales manager. Mr. McClellan was formerly division manager of machine applications for the company.

T. J. AULT, vice-president and assistant general manager of the Detroit Gear Division, Detroit, Mich., of the Borg-Warner Corporation, Chicago, Ill., has been promoted to the post of president and general manager. He succeeds A. P. EMMERT, who has retired.

SCULLY-JONES & CO., Chicago, Ill., manufacturers of "precision holding" and driving tools, announce that their Detroit office has moved to a new location at 19372 James Couzens Highway, Detroit 35, Mich. This office serves seven Michigan distributors in addition to customers in both Michigan and Ohio.

GEORGE HERRICK, who was in charge of the Lansing, Mich., office of the Clearing Machine Corporation, Chicago, Ill., manufacturer of hydraulic and mechanical power press equipment, was recently transferred to the Detroit sales office.

ROCHESTER PRODUCTS, Division of General Motors Corporation, Rochester, N. Y., is opening a regional sales office in Detroit, Mich., in the Melwood Bldg., 8316 N. Woodward Ave. HAROLD STAHL, a sales engineer, will head the new office.

DIE SUPPLY CO., Detroit, Mich., has been appointed distributor for Cerro alloys by the CERRO DE PASCO CORPORATION, New York City, in Michigan, northeastern Indiana, and Lucas County, Ohio.

RUSSELL J. O'NEIL has been appointed a field engineer by the Norton Co., Worcester, Mass., and assigned to the Detroit, Mich., district office. He has been with the company since 1945.

MAURICE M. CLEMONS has joined the Sahlin Engineering Co., Birmingham, Mich., in the capacity of chief engineer.

CARL O. FRIEND has been appointed administrative manager, Heavy Machinery Division, of the Nordberg Mfg. Co., Milwaukee, Wis. Mr. Friend was formerly manager of the Gasoline Marine Engine Dept., a position which will now be filled by HARRISON E. FELLOWS, JR., who was assistant sales manager of this department since 1952. H. W. DOW, JR., formerly mideastern district manager, has been named chief sales technician of the Heavy Machinery Division.

WAUSAU MFG. CO., a subsidiary of Borg-Warner Co., Chicago, Ill., has rented the plant and some of the manufacturing equipment of the Marathon Foundry & Machine Co., Wausau, Wis. J. H. INGERSOLL has been elected president of the Wausau Mfg. Co., FRED W. CEDERLEAF, vice-president and plant manager, and ROBERT F. SCHUTZ, vice-president.

New York and New Jersey

F. JEROME TONE, JR., was recently made senior vice-president of The Carborundum Company, Niagara Falls, N. Y. Mr. Tone was elected vice-president and a member of the board in 1942, and subsequently became vice-president of sales. Mr. Tone will have broad executive responsibilities aassisting and representing the president of Carborundum in many phases of the business. FREDERICK T. KEELER has been appointed director of sales in Mr. Tone's stead. He was formerly director of the marketing branch of the Sales Division, and will now be responsible for directing sales programs of the company and its subsidiaries. In addition, Mr. Keeler will serve as vice-chairman, Abrasive Sales Operating Committee.

GIBNEY - COFFMAN CORPORATION, Buffalo, N. Y., has changed its name to the GIBNEY-DECOT CORPORATION. VAL DECOT has been appointed vice-president. The corporation is a representative in western and central New York for a number of foundry, forging, and gear companies.

JOHN H. BRONSON has been appointed acting advertising manager of the De Laval Separator Co., Poughkeepsie, N. Y., succeeding EARL C. EDGAR, who has resigned as advertising manager. Mr. Bronson joined the De Laval organization three years ago.

TEMPIL CORPORATION announces that all its facilities will be consolidated at 132 W. 22nd St., New York City. Previously, the plant and laboratory were located at this address and the office at 11 W. 25th St.

KASSON DIE & MOTOR CORPORATION, formerly located at 262 Mott St., New York City, has moved to 32-14 Northern Blvd., Long Island City 1, N. Y.

MARAC MACHINERY CORPORATION, which was formerly located at 1819 Broadway, New York City, has moved to 45 S. Broadway, Yonkers, N. Y.

SCOVILL MFG. CO., Waterbury, Conn., announces that its Rochester, N. Y., office has moved from 311 Alexander St. to 175 Dodge St.

E. R. MCCLUNG has been appointed assistant plant manager at Dunkirk, N. Y., for the American Locomotive Co., Schenectady, N. Y.

WILLIAM D. GROSS, works manager at the Spaulding Works, Harrison, N. J., of the Crucible Steel Co. of America, Pittsburgh, Pa., has retired after forty-one years of service with the company. Mr. Gross joined the company as a chemical engineer in 1913, and ten years later became manager of the Spaulding and Jennings Works in Jersey City, N. J. When Crucible combined the facilities of this plant and the Atha Works to form the Spaulding Works at Harrison in 1948, he was named manager of the new installation. Under his management, the two divisions—cold rolled specialties and special products—have increased capacities considerably. PAUL A. KARNS succeeds Mr. Gross. He was formerly manufacturing manager of the Cold Rolled Products Division of the John A. Roebling's Sons Corporation, Trenton, N. J.

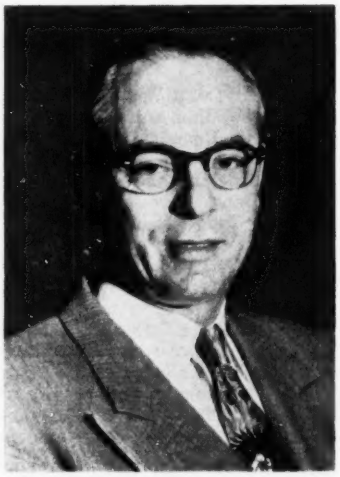
BLOOMFIELD TOOL CORPORATION, Bloomfield, N. J., will now be known as the KIDDE PRECISION TOOL CORPORATION, a subsidiary of Walter Kidde & Co., Inc., Belleville, N. J. The Bloomfield concern is planning a new 61,500-square-foot plant to be located at Roseland, N. J.

R. SMITH SCHENK has joined the White Metal Mfg. Co., Hoboken, N. J., producer of collapsible tubes and metal containers, as a consultant. Mr. Schenk was formerly president of the Sun Tube Corporation, Hillside, N. J.

Ohio

RELIANCE ELECTRIC & ENGINEERING CO., Cleveland, Ohio, has announced the appointment of four application engineers: ARTHUR J. STOCKSLAGER, district sales office, 427 Candler Bldg., Atlanta, Ga.; WALTER A. THORNE, district sales office, 1103 Sterling Bldg., Houston, Tex.; R. C. MARCHANT, branch sales office, 2144 Madison Ave., Toledo, Ohio; and DON S. FOLLETT, branch sales office, 1118 Rockford Trust Bldg., Rockford, Ill. Also announced was the appointment of VERNON BARNES as a field sales engineer. In this capacity, Mr. Barnes will be affiliated with the sales application staff of the C. & G. Sales & Engineering Co., manufacturers' agent in Milwaukee, Wis.

GLENN C. LECHLEITNER has been appointed general manager of the Cleveland Punch & Shear Works Co.,



Glenn C. Lechleitner, who becomes general manager, Cleveland Punch & Shear Works Co.

Cleveland, Ohio. Mr. Lechleitner, who has been with the company for four years, previously held the posts of sales engineer and sales manager.

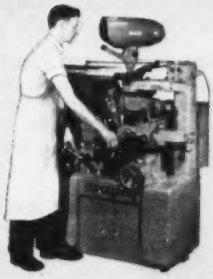
DELCO PRODUCTS DIVISION OF GENERAL MOTORS CORPORATION, Dayton, Ohio, announces the promotion of the following men: ROBERT LAKIN, who was manager of the Detroit, Mich., branch office, has been appointed assistant sales manager with headquarters in Dayton; MARK RASPER, who was supervisor of shock absorber and actuator sales, has become manager of the Detroit office; and CHARLES RICHTER, who was a sales engineer in Detroit, has been made supervisor of shock absorber manufacturing sales at Dayton.

HYDRAULIC PRESS MFG. CO., Mount Gilead, Ohio, announces the appointment of the following men as sales engineers in their respective district sales offices: WILLIAM J. MCMANUS and RAYMOND W. ARNESEN, Teaneck, N. J.; BRUCE H. LOWE and ELTON W. TURNER, Detroit, Mich.; and JOSEPH H. ONDRAS and J. JAY

SHEFFIELD MACHINE TOOLS guard *PRECISION* in the shop

Micro-form Grinder, Model 121 grinds high precision profiles both flat and circular directly from large scale drawing, saving up to 75% over conventional practice.

14

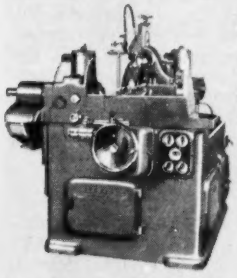


Micro-form Grinder, Model 122 equipped with a combination 30 power microscope and viewing screen.

15

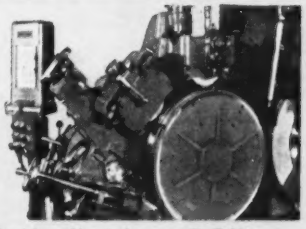
Thread and Form Grinder, Model 133 uses the multi-ribbed wheel principle to grind small precision threads and intricate forms on a high production basis.

16



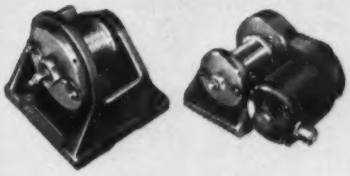
Precision Thread and Form Grinders —100 Series, produce precision threaded elements and cylindrical forms by the Crushtrue method, the diamond dressed multi-ribbed wheel or the single point wheel method.

17



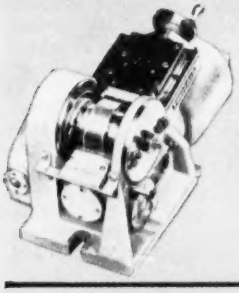
Special machine tools are a Sheffield specialty, such as this one of 12 jet turbine shroud grinders placed in operation within the last six months.

18



Idler and motorized type Crushtrue devices are available for forming grinding wheels on standard surface grinders.

19



Self-truing Motorized Crushtrue Device forms surface grinder wheels for the grinding of flat form tools, etc. of the highest precision and uniformity.

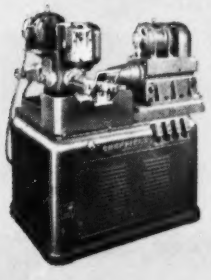
20

The Sheffield Crushtrue Roll Bank plan provides Rolls for production use while worn rolls are enroute to Sheffield for re-grinding and re-ground rolls are enroute from Sheffield for use. Nominal exchange charge.

21

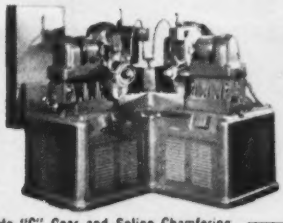
Gear and Spline De-burizers deburr or chamfer up to 600 gear teeth per minute. Applicable to spur, helical, hypoid, bevel and herringbone gears —also multi-start worms.

22



Gear and Spline Chamfering Machines chamfer, burr or recess the ends of gear teeth at high production rates—ideal for short runs and quick changeover.

23



Style "C" Gear and Spline Chamfering machines have two cutter spindles and two workheads for mass production gear manufacture.

24

Sheffield is prepared to produce precision threaded elements and formed parts on contract to augment your own manufacturing facilities.

25

6785

Write for Engineering Data on any or all of these tools identifying them by key numbers in the white squares.

Department 6 • The Sheffield Corporation
Dayton 1, Ohio, U.S.A.

MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD

SMITH, Chicago, Ill. KENNETH V. KEIDEL, who was attached to HPM's central district office in Mount Gilead, has been named a sales engineer to service the Cleveland, Ohio, area.

FRED E. HARRELL, vice-president of the Reliance Electric & Engineering Co., Cleveland, Ohio, has been given the additional duties of director of special projects, a newly created position. Also announced was the promotion of HUGH D. LUKE, formerly manager of central production planning, to the post of manager of manufacturing of rotating equipment. STEPHEN W. FEISS, who was a manufacturing staff project engineer, has been made general superintendent of the company's Ivanhoe Division.

GUY W. SHURMER recently retired as division superintendent of the wire mill at the Cuyahoga Works of the American Steel & Wire Division, Cleveland, Ohio, of the United States Steel Corporation. Mr. Shurmer had served the Division for forty-five years, having progressed through a number of positions from 1908 until 1943 when he was made works superintendent in charge of the wire mills.

ALBERT PATNIK has been appointed to the newly created position of dealer sales manager of the Lincoln Electric Co., Cleveland, Ohio. He will be responsible for the management of the Lincoln dealer organization, numbering some 1000 dealers. Mr. Patnik has been on the Lincoln sales staff since 1940.

LINCOLN ELECTRIC CO., Cleveland, Ohio, announces the addition of the following application engineers to its field staff for servicing arc-welding users: JACK JASO, in the Chicago district; WALTER ROCKWAY in the Cincinnati district; and CHESTER SHIRA in the Jacksonville, Fla., district.

E. W. BLISS CO., Canton, Ohio, announces that its Rolling Mill Division, Salem, Ohio, has acquired the manufacturing rights to the "Weld-a-Matic" splicers from the dissolved Arms-Franklin Corporation.

METAL CARBIDES CORPORATION, Youngstown, Ohio, has appointed the following sales engineers: SAM ERNST, at Chicago, Ill.; JOSEPH R. WEISS, JR., at Cincinnati, Ohio; and WILLIAM HUDAK at Newark, N. J.

JAMES L. GOODWIN has been made Cleveland, Ohio, district manager by the Sterling Abrasives Division of the Cleveland Quarries Co., Tiffin, Ohio. His offices will be at 2333 St. Clair Ave., Cleveland.

CHARLES F. WALTON has been appointed technical director of the Gray Iron Founders' Society, Cleveland, Ohio. Mr. Walton was formerly a professor of metallurgy at the Case Institute of Technology.

Pennsylvania

EDWIN Y. BREADY, director of purchases for the Standard Pressed Steel Co., Jenkintown, Pa., has been promoted to division manager of the Hallowell Pressed Steel Division. CHARLES A. THOMAS, JR., manager of industrial relations and industrial engineering, has been given company-wide charge of production control, quality control, and estimating and cost analysis, in addition to his previous duties. JAMES L. MACDOWELL has been advanced from manager of tooling and quality to superintendent of manufacturing, Fastener Division. The company has also announced at this time the completion of a $10,000,000 phase of its program of expansion and modernization, by which its floor space has been doubled to 650,000 square feet in the last four years.

TECHALLOY CO., INC., has been formed to specialize in the cold drawing of wire in the following materials and sizes: nickel, Monel, and Inconel—from 1/2 to 0.002 inch; and Techalloy stainless steel—from 1/4 to 0.002 inch. The company is located at Rahns, Pa., which is in the Philadelphia area. D. M. SCHMID is president and treasurer, and RALPH CUBBLER, vice-president and secretary.

JOSEPH P. VILLO has been appointed division manager of aircraft and allied products by the Standard Pressed Steel Co., Jenkintown, Pa. Mr. Villo was formerly superintendent of form and finish. Also announced was the promotion of FREDERICK D. FERNSLER to manager of the Unbrako-Flexloc Division. He was manager of production control previously.

ALDEN SUPPLY CO., INC., Philadelphia, Pa., has been named distributor for the CARBOLOY DEPARTMENT OF GENERAL ELECTRIC CO., Detroit, Mich., and will carry the Carboloy line of standard cemented carbide tools and blanks, carbide-tipped masonry drills, and diamond wheel dressers.

VULCAN MACHINE CO., Waynesboro, Pa., has purchased the MINNICH MACHINE WORKS, INC., Landisville, Pa. Vulcan will continue to manufacture the Minnich line of baling presses at the Landisville plant. However, the mailing address for the Minnich Machine Works will be Waynesboro.

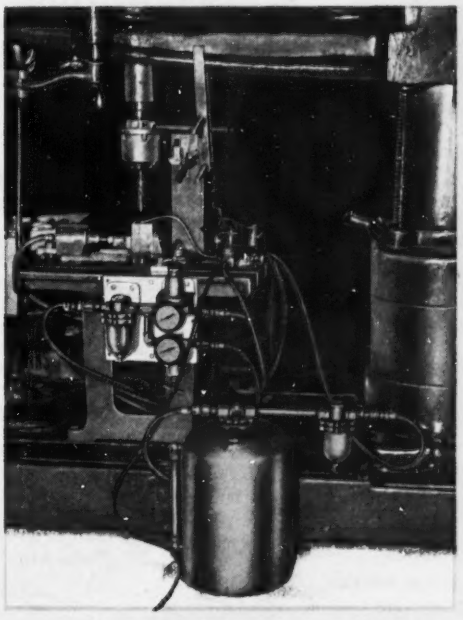
(Left to Right) Charles A. Thomas Jr., James L. MacDowell, and Edwin Y. Bready—key men who have been promoted by the Standard Pressed Steel Co.

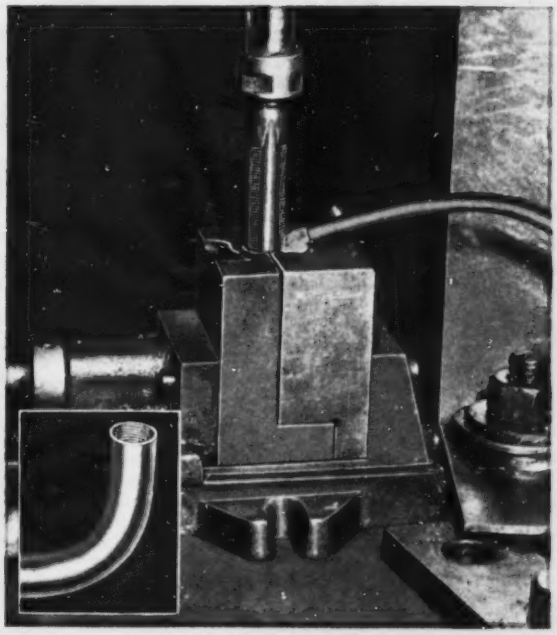
NEW *Norgren* **Spray -Lube** *System*

applies special compound for tapping 100% thread in thin-wall aluminum tubing

increases output 35%
improves quality
eliminates hand operation

at
STANDARD TOOL & MACHINE CO.
St. Louis





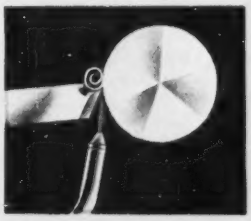
Norgren Spray-Lube System gives more efficient application of cutting oils for:

- ***higher cutting speeds***
- ***faster rate of feed***
- ***longer tool life***
- ***lower unit production costs***

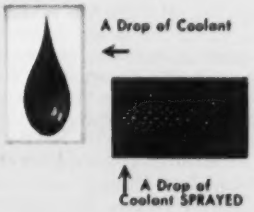
on tapping machines, drill presses, milling machines, grinders, lathes, boring machines, high-speed saws, stamping presses, deep draw presses.

WRITE FOR COMPLETE DATA
NEW FOLDER No. 491

C. A. *Norgren* CO.
3419 So. Elati, Englewood, Colo.



Coolant where you need it . . . spray is applied to work area from any required direction to thoroughly lubricate critical contact areas between cutting tool and work piece.



Fine spray rapidly dissipates heat . . . the spray lubricates tool more efficiently; has greater exposed oil surface area for fast, thorough dissipation of heat.

PIONEER AND LEADER IN OIL-FOG LUBRICATION FOR 26 YEARS

VALVES FILTERS HOSE ASSEMBLIES REGULATORS LUBRICATORS

FIRTH STERLING, INC., Pittsburgh, Pa., has assigned the following men to its New England, Detroit, and Mideastern districts: WILLIAM H. PERRY, DAVID G. CROWNOVER, and WILLIAM K. NEFF, respectively.

SYD. GENSKE announces the reopening of his office for machine tools and gadget design at the following address: The Gadget Designer, 725 Walnut St., Philadelphia 6, Pa.

S. G. TAYLOR CHAIN CO., Hammond, Ind., has opened a new plant in Pittsburgh, Pa., to serve eastern industry in its requirements for alloy steel sling chains.

Rhode Island and Vermont

HAROLD E. MARTIN was recently named superintendent of a newly created Metal Cutting Tool Division

Harold E. Martin, superintendent of the new Metal Cutting Tool Division, Brown & Sharpe Mfg. Co.

of the Brown & Sharpe Mfg. Co., Providence, R. I. In his new responsibilities, Mr. Martin will have full charge of the present cutter manufacture, hardening, and engineering departments, as well as the cutter office. He has been with the company for over thirty years.

RICHARD F. COE has been appointed advertising manager of the Taft-Peirce Mfg. Co., Woonsocket, R. I. Mr. Coe has been associated with the company since 1953.

C. I. HAYES, INC., Cranston, R. I., has begun construction of a furnace-building plant. The company has manufactured industrial electric heat-treating furnaces since 1905.

J. H. Beardsley, recently elected executive vice-president of the Bryant Chucking Grinder Co.

J. H. BEARDSLEY was recently elected executive vice-president of the Bryant Chucking Grinder Co., Springfield, Vt. Mr. Beardsley has been a director of Bryant since 1946, although he came to the company two years later from the Jones & Lamson Machine Co., also of Springfield. Since then, he has served as assistant to the president, general manager, and vice-president. Mr. Beardsley is also president of the E. G. Staude Mfg. Co., Inc., St. Paul, Minn., a subsidiary of Bryant.

GLENN D. EASTON has been appointed chief engineer of the Lovejoy Tool Co., Inc., Springfield, Vt., succeeding E. B. LUCARINI, who is retiring.

West Virginia and North Carolina

W. H. NESBITT recently retired from the Wheeling Corrugating Co., Wheeling, W. Va., of which he was assistant vice-president. Mr. Nesbitt had been with the company for more than fifty-three years.

JONES & LAMSON MACHINE CO., Springfield, Vt., has opened a new district office at Plaza Station, Charlotte 5, N. C. E. H. WELLS, who has been representing the company in the South for the last four years, has been appointed manager of the Charlotte office. Under his supervision will be a staff of both sales and service personnel for all five of Jones & Lamson's major products—turret lathes, automatic lathes, automatic thread and form grinders, optical comparators, automatic opening die-heads, and chasers. In addition, the office will stock a line of die-heads and chasers.

Obituaries

HENRY DUCKWORTH, retired vice-president of the Norton Co., Worcester, Mass., died on April 1 in Palm Beach, Fla., at the age of eighty-two years. Mr. Duckworth began his Norton career in 1890 when at eighteen he was hired as an office boy. He worked for the company for more than sixty years, holding various positions. He was named assistant treasurer in 1919, a director two years later, and in 1941, a vice-president. Mr. Duckworth had also been a controller and a member of the executive committee. He retired on January 1, 1953.

CHARLES C. BIGELOW, president of the City Auto Stamping Co. and City Machine & Tool Co., Toledo, Ohio, died suddenly on March 31 at the age of fifty-six years. Mr. Bigelow was associated with the two companies for twenty-five years, and was well known throughout the automotive, aviation, and other heavy goods industries for which his companies produced metal stampings and dies.

Coming Events

MAY 4-7—National spring technical meeting of the AMERICAN WELDING SOCIETY to be held at the Hotel Statler, Buffalo, N. Y., in conjunction with the Second Welding and Allied Industry Exposition at the Buffalo Memorial Auditorium. National secretary, J. G. Magrath, 33 W. 39th St., New York 18, N. Y.

MAY 17-20—SECOND BASIC MATERIALS EXPOSITION AND CONFERENCE to be held at the International Amphitheatre, Chicago, Ill. For further information, write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MAY 31-JUNE 11—Seventh CANADIAN INTERNATIONAL TRADE FAIR to be held at Exhibition Park, Toronto, Ontario, Canada. For further information, write to C. C. Hoffman, Trade Fair Administrator.

JUNE 6-9—Annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION to be held at the Homestead, Hot Springs, Va. Executive secretary, John C. Sears, One Thomas Circle, Washington 5, D. C.

JUNE 7-10—Sixth National Plastics Exposition sponsored by the SOCIETY OF THE PLASTICS INDUSTRY, INC., at the Public Auditorium in Cleveland, Ohio. Chairman, P. H. Grunnagle, Society of the Plastics Industry, Inc., 67 W. 44th St., New York 18, N. Y.

(*Continued on page* 268)

Linked TOGETHER FOR MAXIMUM PRODUCTION

CO-ORDINATION Produces Carbide Tools That Link the World's Finest Machine Tools to TOP-PRODUCTION!

Maximum production is possible only when you have coordination of:

1. **The creation of the proper grade of carbide.**
2. **Tools designed to get the utmost efficiency from that carbide.**
3. **The intelligent application of both to a machine tool designed for maximum production.**

The WESSON MAN

in your area has many case histories in the form of Progress Reports. Ask him for details.

WESSON COMPANY
1220 WOODWARD HEIGHTS BLVD.
FERNDALE (DETROIT 20) MICHIGAN

WESSONMETAL CORPORATION
LEXINGTON 34, KENTUCKY

JUNE 9-11—Eighth Annual Convention of the AMERICAN SOCIETY FOR QUALITY CONTROL to be held at the Jefferson Hotel, St. Louis, Mo., with technical sessions at the Kiel Auditorium. Further information can be obtained from U. C. Gramsch, Registrar, Box 4436, Wade Station, St. Louis 15.

JUNE 13-18—Fifty-seventh annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS and eleventh exhibit of testing and scientific apparatus and laboratory supplies to be held at the Hotel Sherman, Chicago, Ill. For further details, write to the Society, 1916 Race St., Philadelphia 3, Pa.

New Books and Publications

GEARS. By H. E. Merritt. 527 pages, by Sir Isaac Pitman & Sons, Ltd., London, England, and sold in the United Sates by the Pitman Publishing Corporation, 2 W. 45th Street, New York 36, N. Y. Price $12.50.

This third edition, adapted to meet the needs of designers, engineers, students, and, in fact, all persons interested in gears and gearing, has been rearranged and very largely rewritten. It incorporates new material and new treatments. Ten chapters have been added to this edition. Separate chapters are included covering the geometry of involute spur gears, helical gears, spiral and conical involute gears, bevel gears, worm gears, and gear generating cutters. Separate chapters on the detail dimensions of spur gears, helical and spiral gears, bevel gears, and wormgears are also included.

A new chapter involving some special gear-tooth applications has been inserted. It contains material on involute clutches and splines, gear pumps, gears for clockwork mechanisms, and gears for nonuniform motion. Rating methods have been re-expressed to give a more rational connection to the various assumptions. This re-expression is accompanied by a full range of recalculated charts.

ANTI-FRICTION BEARINGS. By Hudson T. Morton. 395 pages, 8 1/4 by 11 inches; 60 tables and charts. Published by Hudson T. Morton, 815 Wildt St., Box 355, Ann Arbor, Mich. Price, $7.75 (loose-leaf, spiral bound).

This book is intended as a textbook and reference guide for engineers and machine designers to teach the fundamentals of bearing design and application. Bearing users are given in simple language technical information on practical handling. According to the author, leading engineers in the bearing industry have cooperated with him in compiling the up-to-the-minute data in this manual. It covers the history of bearing design and manufacturers; types of ball bearings, roller bearings, tapered roller bearings, self-aligning roller bearings, and thrust bearings; seals and shields; metallurgy; standardization; bearing capacity, selection, and mounting data; lubrication; preloading; and completion of bearing life.

METAL CUTTING TOOL HANDBOOK. 689 pages, 6 by 9 inches. Published by the Metal Cutting Institute, 405 Lexington Ave., New York 17, N. Y. Price, $7.50.

This revised edition of the Handbook—which is devoted exclusively to metal-cutting tools and their use—presents the latest data on twist drills, reamers, counterbores, taps, dies, milling cutters, gear shaper cutters, gear shaving cutters, and broaches. In each section there is information on the design, proper application, and the maintenance procedures of the tools described. This is followed by tables of dimensions and tolerances of standard sizes of tools. The book concludes with a section giving engineering tables and other data commonly used in the metal-cutting industries. The material was originally compiled by a committee of engineers who gathered the data from manufacturers of metal-cutting tools, and the information has been revised in the light of new developments in the fields of tool materials, tool design, and materials to be cut.

ELEMENTS OF MECHANISM. By Venton Levy Doughtie and Walter H. James. 494 pages, 5 1/2 by 8 1/2 pages. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $6.

The present book was rewritten by Mr. Doughtie and based on a number of earlier editions dating back to 1885. While much of the material has been retained, the wording, terminology, and examples have been brought up to date. The book is intended to give the student familiarity with the application of the fundamental principles of physics and simple mathematics in the field of mechanical movements. The chapter headings indicate the scope of the book: Motion; Velocity Analysis; Acceleration Analysis; Linkages; Transmission of Motion by Direct Contact; Cams; Bodies in Pure Rolling Contact; Gears; Belts, Ropes, and Chains; Trains; Miscellaneous Mechanisms; and Problems.

FUNDAMENTALS OF THE WORKING OF METALS. By G. Sachs. 158 pages, 5 1/2 by 8 1/2 inches. Published by Interscience Publishers, Inc., 250 Fifth Ave., New York City. Price, $4.75.

This book assembles a number of articles that previously appeared in *The Modern Industrial Press*. It contains an elementary description of the basic phenomena which determine the performance of metallic materials on mechanical working. Following are the chapter headings: Effects of Temperature and Speed on Forming; Relations between Chemical Composition, Phase Changes, and Forming Characteristics; Effects of Grain Structure on Forming; Some General Concepts of Metal Forming; Basic Types of Forming Methods; and Progressive Fabricating.

CIRCULAR AND DIAMETRAL PITCH KNURLING (Knurl Data 50-10). 21 pages, 8 1/2 by 11 inches. Published by the Reed Rolled Thread Die Co., Box 350, Worcester 1, Mass. Price, 75¢ (paper-bound).

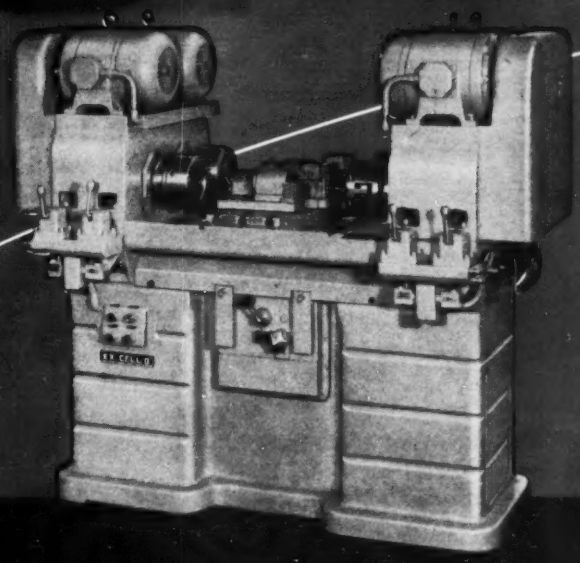
The engineering data contained in this pamphlet have been prepared by the company to provide a source of condensed technical information on knurling for design and process engineers and those actively engaged in the application of the knurling process. The following are the chapter headings: General Information; Reed Circular Pitch Knurling; Diametral Pitch Knurling; Selection of Knurling Tools; Knurling on Screw Machines and Lathes; and Knurling on Thread Rolling Machines.

THE CLOSED DIE FORGING PROCESS. By P. E. Kyle, 140 pages, 5 1/2 by 8 1/2 inches. Published by the Macmillan Co., 60 Fifth Ave., New York 11, N. Y. Price, $1.50.

The purposes of this book are to describe briefly the essential steps in producing drop forgings and to discuss some of the uses to which the various closed die forgings can be adapted. The properties of forging metals are dealt with to some extent, and the fundamentals of hotworking are explained. A glossary of forging terms is included.

AMERICAN STANDARD DESIGNATION AND WORKING RANGES OF GRINDING MACHINES (ASA B5.32-1953; B5.33-1953). 7 pages, 8 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, $1.

AMERICAN STANDARD ROTATING AIR CYLINDERS AND ADAPTERS (ASA B5.5-1954). 6 pages, 8 1/2 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, $1.

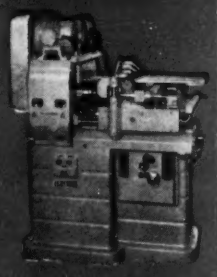


XLO
EX-CELL-O for PRECISION

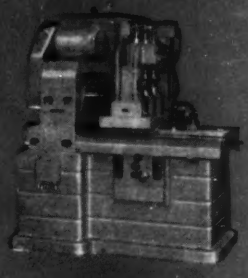
STYLE 1212-A. For identical or different operations at each end. When loading time of parts approximates the time of machining, a double-end machine practically doubles production capacity.

You buy Profit Insurance

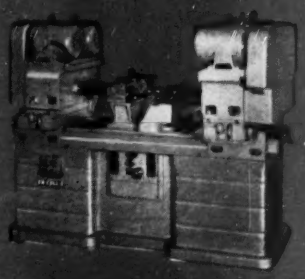
when you replace obsolete equipment with these MODERN COST-SAVING MACHINES



STYLE 2112-A. Single-end model for workpieces in the small and medium-size range. Flexible hydraulic controls give easy adjustment of multiple operations.



STYLE 112-C. Large and sturdy with long stroke. Accommodates medium and heavy work, gives maximum precision production, minimum operating cost.



STYLE 17. Massive construction. Maintains the highest precision standards on a profitable production basis. Economical in operation, can be set up for variety of jobs.

With this versatile equipment, you can precision bore, turn, face, counterbore, chamfer, and groove.

These machines are standard, yet they'll handle a large variety of precision operations. Ex-Cell-O also has the standard items of tooling to make this possible at minimum cost.

These fast, sturdy, flexible Ex-Cell-O machines are *profit insurance*. For years to come they will keep on turning out *precision work at maximum production speeds.*

EX-CELL-O
Precision
BORING MACHINES

Get all the facts about them from your local Ex-Cell-O representative, or write for a Precision Boring Catalog.

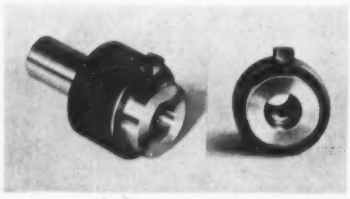
EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

54-2

Amcam "Tap-Holeder"

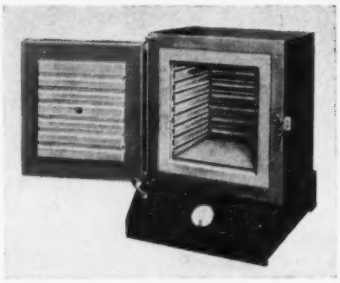
Amcam "Tap-Holeder" with a center hole running all the way through instead of having a blind hole as in conventional tap-holders. This feature makes it



possible to insert a full length tap without grinding off part of the shank in order to seat the tool in a blind hole. The through-hole also makes it possible to extricate a broken tap without removing the holder bushing or disassembling the holder from the machine. Made by the American Cam Co., Hartford 1, Conn. 150

High-Speed Air-Electric Gage for Polished Part

Air-electric gage developed by the Federal Products Corporation, Dept. M, 1144 Eddy St., Providence 1, R. I., for simultaneously measuring two outside diameters of a highly polished bearing. The measurements are taken with a dual air snap and then transferred through an air-electric switch to the "Electricator" unit. This unit, in turn, operates a set of tolerance lights. If both dimensions are correct, the green light flashes; if either diameter is under size, the amber light alerts the operator; while a red light indicates over size. A glance at the large Dimensionair dials shows which dimension is off and how much. The use of air as the measuring method provides a high degree of accuracy and eliminates the danger of marring polished surfaces. .. 151



"Dyna-Trol" Furnace that can be Used for Calibration and Instrumentation

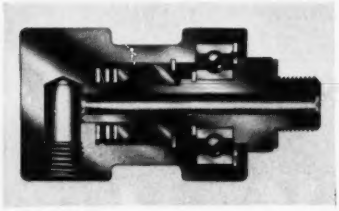
"Dyna-Trol" furnace of new line brought out by the L & L Mfg. Co., Chester 67, Pa. These industrial electric furnaces operate at temperatures up to 2000 and 2300 degrees F. They will reproduce any time-temperature curve within plus or minus 3 degrees F. The new Dyna-Trol line consists of over forty standard models, with special models also available. It offers infinite zone control from 8 to 100 per cent of the input. This allows for complete and accurate equalization of vertical zone temperatures at any time-temperature curve. 152

Crystal Type Accelerometer Vibration Detector

Highly sensitive, crystal type accelerometer developed by the General Electric Co., Dept. M. Schenectady 5, N. Y., as a basic detection element for use in measuring vibration acceleration in large rotating apparatus. It is designed for use on turbine generators, large motors, blowers, steam and gas turbines, centrifuges and similar equipment. 153

Barco Revolving Joint

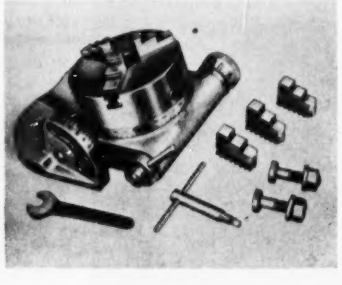
Improved, light-running revolving joint with inside diameter of 1/4 inch announced by Barco Mfg. Co., Dept. J-20, 500 Hough St., Barrington, Ill. This joint is designed for making air or hydraulic piping connections to clutches, power transmission drive units, chucks, spindles, grinding wheels, and



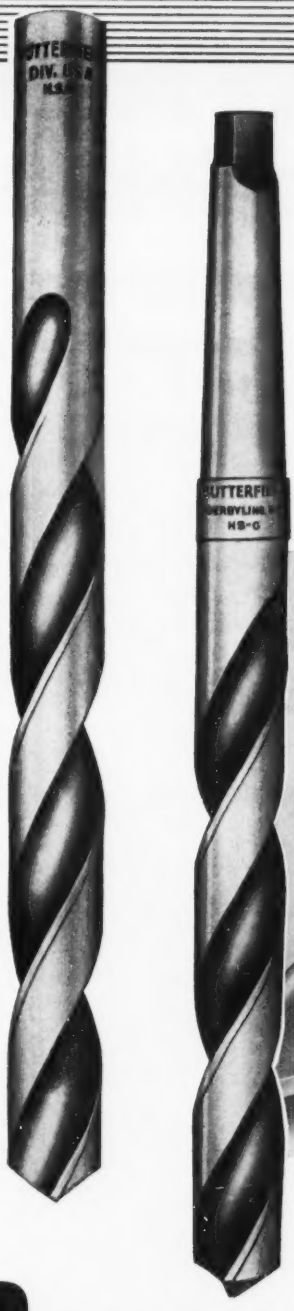
other rotating machine parts. It has a compact bronze casing, special spring-loaded V-ring seals, hardened and ground steel shaft, and a permanently lubricated sealed ball bearing. The over-all length is 3 5/8 inches. The joint can be used at temperatures up to 180 degrees F. and at pressures up to 300 pounds per square inch for air and 1500 pounds per square inch for hydraulic service. It can be operated at speeds up to 2500 R.P.M. 154

"Panto" Dividing Head

Dividing head announced by H. P. Preis Engraving Machine Co., Dept. M, 165 Industrial Branch, Hillside, N. J., which can be adjusted from a horizontal to a vertical position, and also rotated a full 360 degrees. This dividing head has a fine precision adjustment in minutes of angle for rotary micro setting, and its equipment includes a three-jaw, three-step chuck. Designated the Model DH-4 Preis "Panto" dividing head, this equipment is intended for use in engraving, drilling, light milling, profiling, and lay-out work on cams and cylindrical parts. .. 155

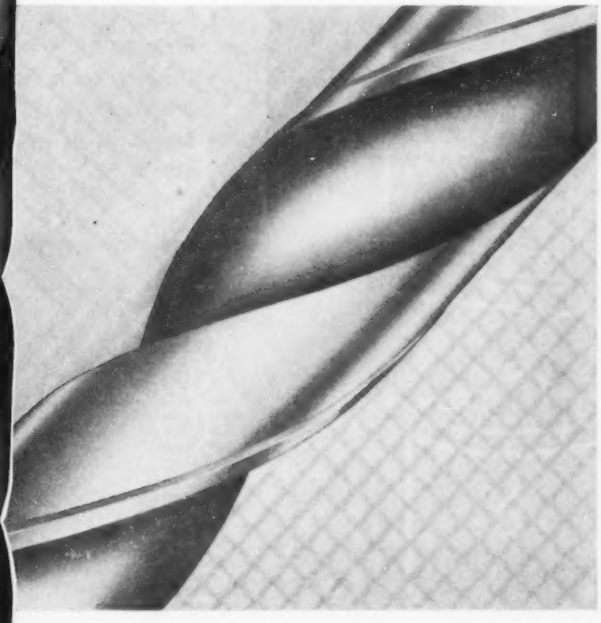


For more information on these products, use Inquiry Card, page 247



DESIGNED, ENGINEERED

Designed, engineered and produced for maximum performance — Butterfield Drills.



BUTTERFIELD

UNION TWIST DRILL COMPANY
BUTTERFIELD DIVISION
DERBY LINE, VERMONT, U. S. A.

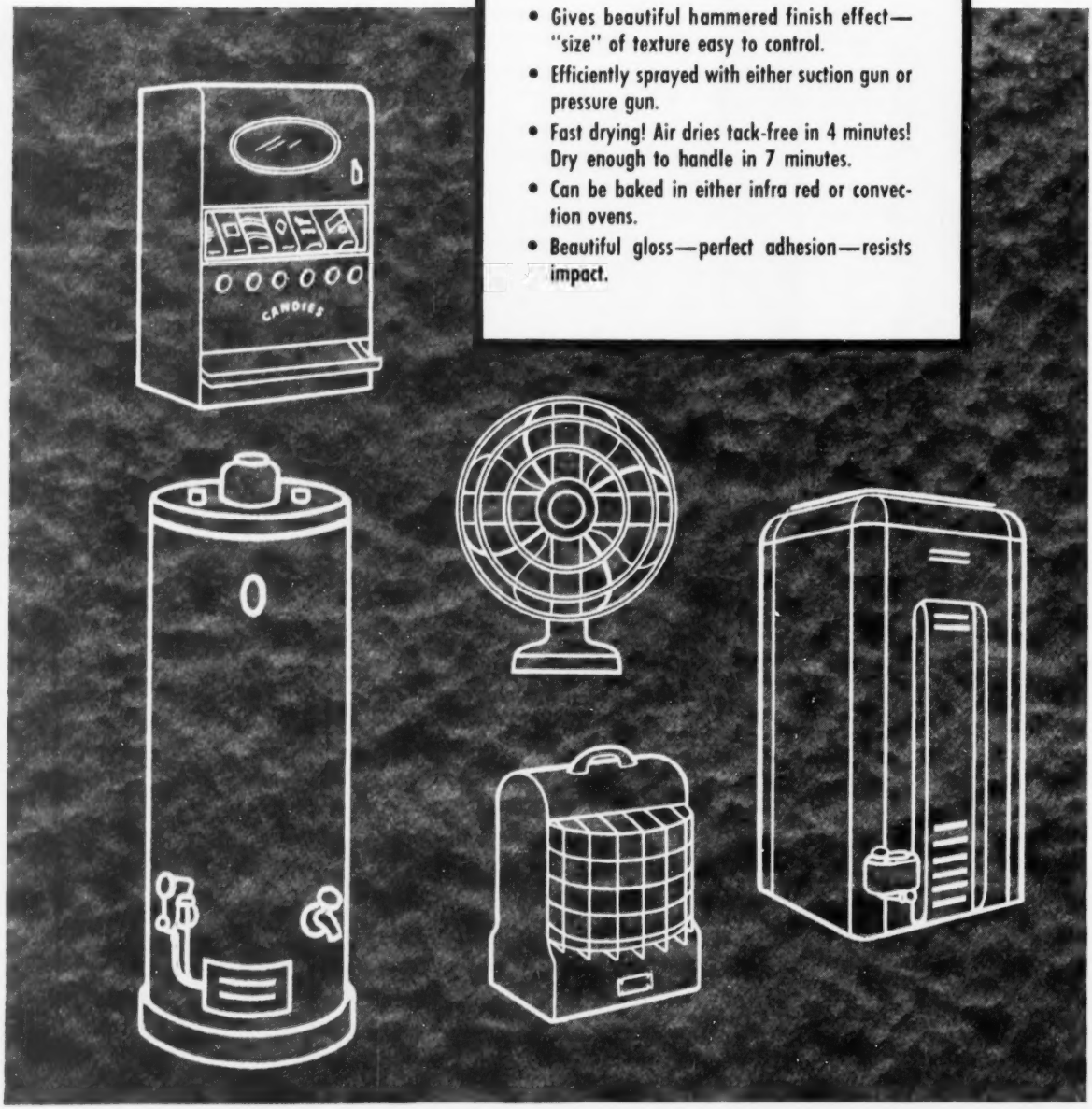
TAPS • DIES • DRILLS • REAMERS • COUNTERBORES • SCREW PLATES

FOR BETTER SERVICE
Call Your
BUTTERFIELD
DISTRIBUTOR

Lowetex -- New Lowe Brothers 3 Operations, Increases

Here's the "lowdown" on Lowetex!

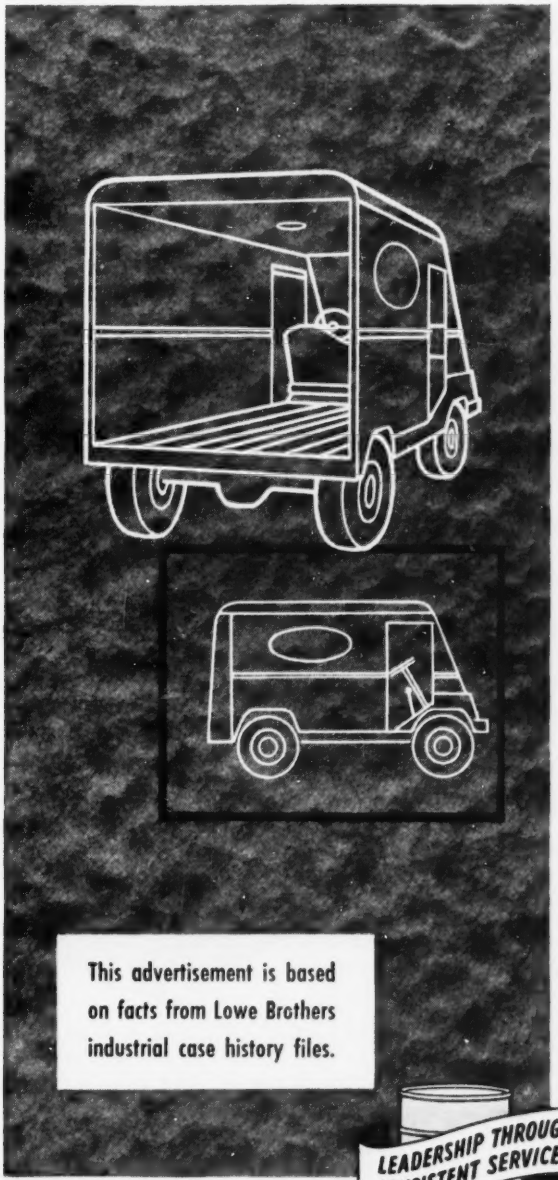
- Gives beautiful hammered finish effect—"size" of texture easy to control.
- Efficiently sprayed with either suction gun or pressure gun.
- Fast drying! Air dries tack-free in 4 minutes! Dry enough to handle in 7 minutes.
- Can be baked in either infra red or convection ovens.
- Beautiful gloss—perfect adhesion—resists impact.



✻ New fast-drying *Lowetex* is ideal for any surface where a good looking, long-wearing hammered finish is desired. Coin machines, cigarette machines, heaters, furnaces, bases for fans—these are just a few typical examples. Perhaps *Lowetex* will lower *your* finishing costs. Write today.

"Hammered" Finish--Eliminates Manufacturer's Production!

Oven time savings-50%
Labor savings - - - 40%



This advertisement is based on facts from Lowe Brothers industrial case history files.

In applying a hammered finish to truck interiors, a manufacturer found it necessary to *bake* the finish before masking it for the *exterior* finishing job. Thus, two complete baking cycles were required. A Lowe Brothers "Finishing Specialist" recommended *Lowetex**—sensational new fast drying hammered finish. After only 15 minutes of *air drying, Lowetex* was ready for interior metal masking—making it possible to spray *exterior* surfaces promptly and bake *both* interior and exterior finishes in *one* trip to the oven! Two costly handling operations and an entire baking cycle were eliminated. Oven time saved—50%! Labor saved—40%! Moreover, production potential was greatly increased by faster flow of units through the finishing process!

Whatever *your* product or finishing problem, let a Lowe Brothers "Finishing Specialist" give you the benefit of his knowledge and experience. There's no obligation—and many manufacturers will tell you it pays big dividends. Write today!

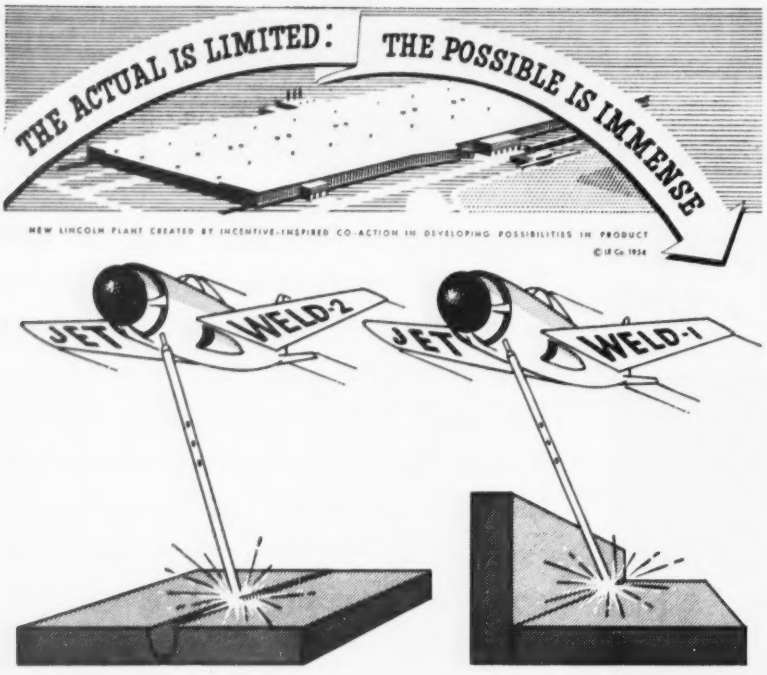
THE LOWE BROTHERS COMPANY • Dayton, Ohio
Industrial Division

District Offices: Atlanta, Boston, Chicago, Jersey City, Kansas City

LEADERSHIP THROUGH CONSISTENT SERVICE

Lowe Brothers
FINISHES FOR INDUSTRY

since 1870


THE ACTUAL IS LIMITED: THE POSSIBLE IS IMMENSE
NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT
© LE Co. 1954
JET WELD-2
JET WELD-1

JETWELD'S COST-CUTTING TEAM SPEEDS WELDING 35% AND MORE

FOR THE FIRST TIME, Lincoln Jetweld joins powdered metal with the electrode to achieve fastest hand welding speeds ever accomplished. Jetweld's phenomenal speed lies in utilizing the maximum heat of the arc for melting the parent metal, core wire and coating.

GET JETWELD'S COST-CUTTING FACTS TODAY... Have your Lincoln welding engineer demonstrate Jetweld's many cost saving features. Or write for free Bulletin 481.

JETWELD-2 (E-6020)

Extra fast electrode for flat, deep grooves and flat and horizontal fillets.

Tensile strength (As welded) 62,000 psi minimum

Yield strength (As welded) 52,000 psi minimum

Elongation in 2" (As welded) 25% minimum

JETWELD-1 (E-6012)

Extra fast electrode for flat and horizontal fillets.

Tensile strength (Stress relieved) 80,000—90,000 psi

Yield strength (Stress relieved) 65,000—75,000 psi

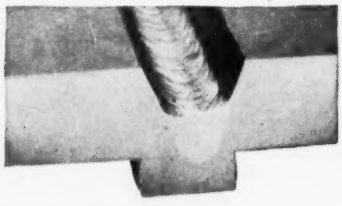
Elongation in 2" (Stress relieved) 25%—30%

Jetweld electrodes have been tested and approved by the American Bureau of Shipping and are certified to conform to AWS classes E-6012, modified, (Jetweld 1) and E-6020 (Jetweld 2).

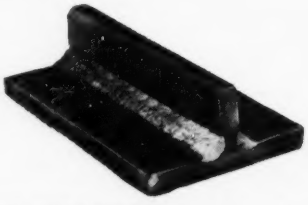
This certification authorizes the use of these two electrodes in shipbuilding supervised by the American Bureau of Shipping and the U. S. Coast Guard.

BENEFIT THREE WAYS WITH LINCOLN JETWELD

35% AND FASTER welding speeds are possible with the new Lincoln Jetweld electrodes. That's because powdered metal coatings utilize the heat of the arc more efficiently to increase welding speeds. Iron powder, melted by excess heat available in the arc, becomes an additional source of metal for the weld.



HIGHER QUALITY Weld metal is uniform, of X-ray quality, free of undercut with improved impact values at low temperatures. There is no coating breakdown . . . stub losses are less. Bead appearance is smooth . . . looks like an automatic weld.



LESS CLEANING is required with Jetweld. Heavy coating and short arc prevent spatter. Slag is self-cleaning. Excellent "wash-up" eliminates undercutting and entrapped slag.

THE LINCOLN ELECTRIC COMPANY

Dept. 1203

CLEVELAND 17, OHIO

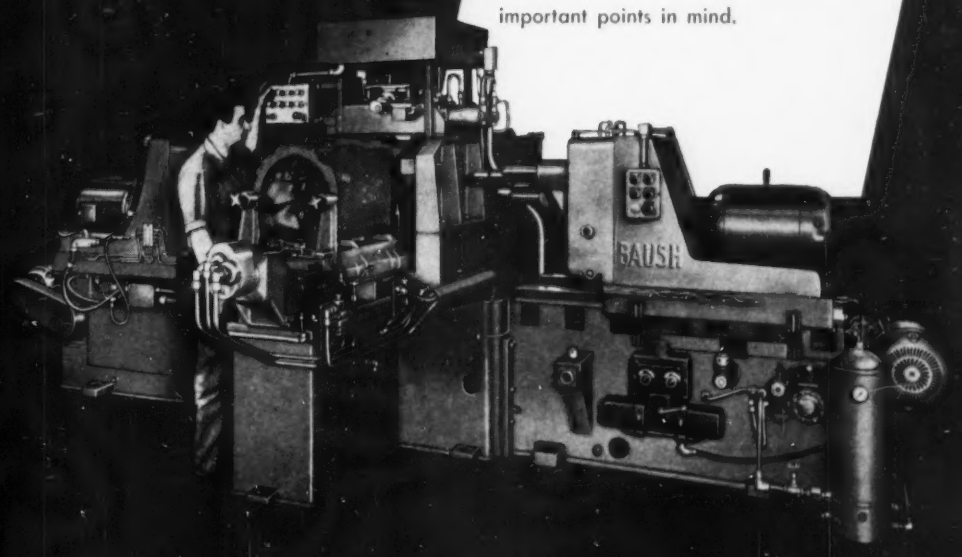
THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

For more information on products advertised, use Inquiry Card, page 247

Machine Tool Modernization is a MUST!!

HOW ABOUT YOUR EQUIPMENT?
Does it meet today's demands for low cost, high speed production?

Every Baush Machine Tool — from a single-operation multi-spindle tapper or drilling machine, to multi-station transfer lineups — is designed specifically for YOUR JOB with these two important points in mind.



Note the compact efficiency of this Baush 3-Way Horizontal Multi-spindle drill illustrated.

Designed to counterbore, chamfer, ream and spotface rear end as well as left hand and right hand sides of a heavy tractor transmission case, this machine consists of

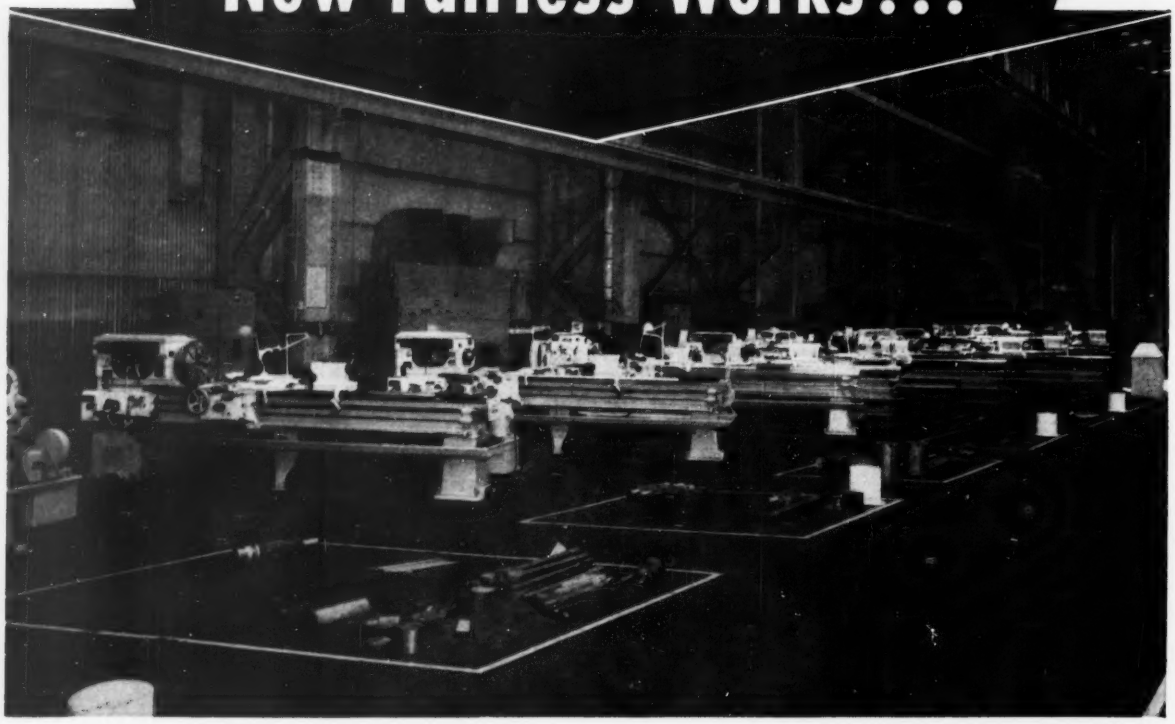
1 — 30F — 18T Hydraulic unit
2 — 30F — 18 Hydraulic units
1 — 11 spindle F.C.Head for rear unit
1 — 8 spindle F.C.Head for left hand unit
1 — 8 spindle F.C.Head for right hand unit
1 Holding Fixture

Production: 35 parts per hour at 100% efficiency. "Baush" has meant Machine Tool Quality for more than 60 years because Baush has kept abreast of modern demands in their design and construction.

WHY NOT USE THIS EXPERIENCE WHEN YOU NEED MODERN MACHINE TOOLS? Wire, 'phone, or write us NOW.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

13 LEHMANN Engine Lathes NOW at work in U. S. Steel's New Fairless Works...



The largest integrated steel mill to be built at one time uses LEHMANN Lathes in its modern maintenance shops!

The Fairless Works, built on 3,900 acres and one of the biggest expansion projects built in our time, incorporates the most modern steel mill equipment available. One of the big jobs at Fairless is that of maintenance. Special shops to keep all the equipment used in this 2.2 million ton plant in top running order are an important part of Fairless.

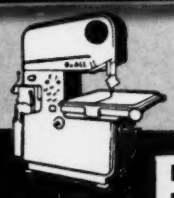
The machine tools, cranes and other equipment necessary for cleaning, machining and repairing the mill operating equipment (which, in fact, make practically all repairs required at Fairless) include 13 Lehmann engine lathes! Some of these lathes are shown in the above photo.

Find out how Lehmann Lathes can bring efficiency, safety and speed to the operations in your plant. Write today for information or catalog — or — send prints for time and money saving recommendation.

LEHMANN
MACHINE COMPANY
GRAND at CHOUTEAU • ST. LOUIS 3, MO.

DIVISION OF NOVO ENGINE CO.

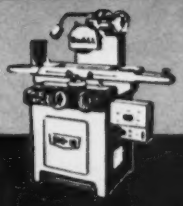
For more information on products advertised, use Inquiry Card, page 247


BAND MACHINES

BAND TOOLS

DoALL PRODUCTION NEWS

GAGE BLOCKS


SURFACE GRINDERS

SAW BANDS • GAGING EQUIPMENT • TOOL STEEL • CUTTING TOOLS • INDUSTRIAL SUPPLIES

Vol. 3 Published by DoALL Company, 254 N. Laurel Ave., Des Plaines, Ill. No. 2

New Bausch & Lomb Bench Comparator Prevents Production Errors at The Machine

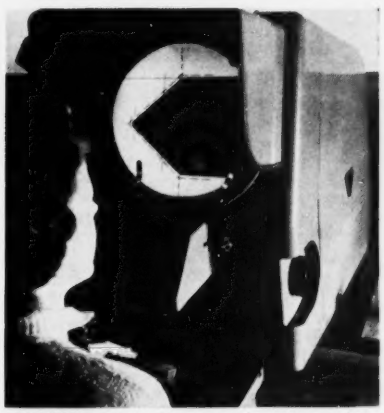
Lowest Priced Optical Comparator of its Size and Quality; Sold Exclusively by DoALL

Charts and Staging Fixtures for Comparators Also Available Through DoALL

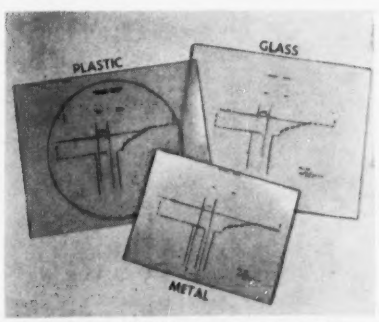
A new, low priced bench type optical comparator manufactured by Bausch & Lomb Optical Company is now available exclusively through DoALL Service-Stores. The new unit is designed for use in the shop alongside the machines to permit fast, accurate inspection of both parts and tools. It projects a magnified image of the object on a ground glass screen. The dimension or contour is visually checked against reference lines or a chart on the screen, enabling the operator to detect deviations from accuracy before tolerances are exceeded. Inaccurate set-ups, worn tools or other sources of inaccuracy can be corrected before rejections occur.

The instrument also finds application in the inspection lab and for checking of incoming parts.

TOOL WEAR CAN BE SPOTTED by parts inspection in the shop. Tools can be adjusted before error occurs.



MAGNIFIED IMAGE of single point tool is compared against reference lines on comparator screen.



DUPLICATE CHARTS can be made with perfect accuracy on glass, plastic or metal. Any number of suppliers and customers can thus perfectly duplicate production and inspection.

Measures to .0001"

Priced below any comparator of comparable quality and size, the new B&L instrument has a 10" round screen and will measure to a least dimension of .0001". It features understage illumination which eliminates the need for special fixtures when checking any part that can be laid on the horizontal stage.

The perfection of the Bausch & Lomb optical system provides extreme accuracy and a sharply defined silhouette of the object across the entire diameter of the screen.

Weight of the unit is 110 lbs., length 21", width 15", height 23".

Charts, Fixtures

Special comparator charts and holding fixtures designed and manufactured by Inspection Equipment Co., Birmingham, Michigan, are available through DoALL to provide faster, simpler checking of production runs.

New literature on comparators and charts is available upon request.

Other Optical Instruments

DoALL Stores are also distributors of Bausch & Lomb contour measuring projectors, stereomicroscopes, toolmaker's microscope, Brinell and shop microscopes.

PRODUCTION LINE CHECKING right at the machine. Operator and inspector can both see the accuracy or error.

TYPICAL APPLICATIONS

Checking contours and dimensions of:

Screw machine parts	Machine set-ups
Jet engine blades	Slots—
Cutting tools—Dies	Irregular forms
Springs—Stampings	Phonograph needles
Precision castings	Screw threads
Radio tubes	Jewel bearings
Gears—splines	Form grinding rolls
Involute coils	Keys—Razor blades
Saw Bands	and *thousands* more!

----See Next Page--→

DoALL Single Point Carbide Tools, Tips and Holders

- Finest, controlled quality sintered carbide
- Specific grades of carbides to meet every need
- All sizes, shapes

Call DoALL —consult your classified phone directory for nearest DoALL Service Store that stocks cutting tools, gages, supplies—or Write

DoALL Hefti-Cut Adjustable Tool with DoALL Preformed Carbide Blank

The DoALL Co.
Des Plaines, Ill. 21

DoALL Announces New Low Cost 16" Contour Band Machines

Five Models Expand DoALL Line To Meet Any Requirement

For Toolroom and Light Production Work; Variable Speeds 50 to 5200 Blade Feet Per Minute

With prices starting at $540, a new line of 16" DoALL contour band machines is available to give even the smallest shop all the advantages of modern band machining. Designed for light production and tool room work, these machines give remarkable performance within their size and power range. Quality has not been sacrificed. The low prices are made possible by DoALL design know-how and mass production manufacturing.

There is almost no limit to the jobs which can be profitably handled on the new models. Fixed and variable speed ranges are available for sawing, filing, polishing, friction sawing and carbide tool finishing. Twenty different attachments are available to increase usefulness, output and ease of operation.

Construction

Tables on all models are 24"x24" with 45° tilt to the right and 10° tilt left. Throat depth is 16", work thickness capacity 12".

Frame and housing are unit welded steel. Carrier wheels are aluminum with sealed ball bearings.

Models SFP, LSV, and HSV include a Speedmaster variable speed drive and totally enclosed hardened steel helical gear transmission. Speed ranges of these models are 50 to 5200, 50 to 300 and 850 to 5200 blade feet per minute, respectively.

The Model HS has a fixed speed of 4000 feet per minute, and the HS4 four speeds of 2000, 3000, 4000 and 5000 fpm.

Attachments

Optional equipment for the new 16" DoALL's includes saw blade buttwelders, saw blade shears, automatic power work feed, various types of saw guides, carbide tool finisher attachment, band polishing attachment, rip and mitering fences, tool coolant and air systems, screw feed and work holding jaw, disc cutting attachment, electric etching pencil for toolmaking and others.

Complete data, literature and prices are available upon request.

New 16" x 12" capacity DoALL with some of the new attachments.

Look at those smooth, uniform chips!

DoALL XL TWIST DRILLS

Guaranteed to *last longer* than an ordinary drill!

- Lower tool cost
- Less downtime
- Lower labor cost
- All sizes in stock

Try just one for comparison

Call DoALL

See your classified phone directory for nearest DoALL Sales-Service Store stocking cutting tools, gages, supplies

or Write

The DoALL Company
Des Plaines, Illinois

DoALL OPTICAL FLATS
for Checking Flatness, Size and Parallelism

A size and type for every job

- Purest Quartz
- Accuracies to .000001"
- Diameters to 10"
- Special sizes, shapes made to order

Consult your yellow Directory for location of nearest of the thirty-eight DoALL Sales-Service Stores that stock complete metal working necessities.

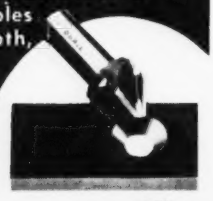
Ask about DoALL Monolights—2" 5", 20" sizes

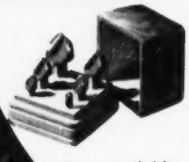
Call or Write The DoALL Co.
Des Plaines, Ill. 14

DoALL CHATTER FREE COUNTERSINKS

...produce holes with a smooth, valve-seat appearance

New off-center flute design. Shears metal—does not gouge. Provides faster, more accurate cutting. Lasts longer. Available in H. S. Steel.





Call DoALL — see classified phone directory for nearest DoALL Service-Store — complete stock of gages, cutting tools, supplies

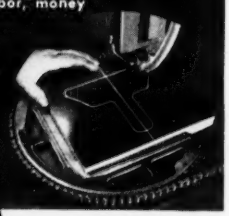
Or Write The DoALL Co.
Des Plaines, Ill. 25

Sets available in 60°, 82°, 90°, 100°, 120° angles

DoALL Precision Tool and Die Steel
(Ground Flat Stock)

Save time, labor, money

- Ready to use for tools, dies, gages, parts
- Parallel, square, precision ground
- Over 230 sizes
- Oil or air hardening



Call DoALL — consult yellow directory for nearest DoALL Service-Store that stocks cutting tools, gages, supplies—or Write

The DoALL Co.
Des Plaines, Ill. 6

Ink it!
Mark it!
Saw it!

Use DoALL Steel Ink

DoALL Demon Defies Dulling

User Reports New High Speed Steel Saw Band Outlasts 4 Carbon Steel Blades and Cuts Sawing Time 91%

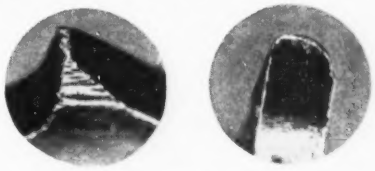
The new high speed steel DoALL DEMON saw bands open up new opportunities for band machining cost reductions. Designed with one thought in mind—get the work out faster, easier, and at a less cost—they are already proving their worth in a wide variety of jobs. When used with the new, heavier duty, power feed DoALL Band Machines, real economies are immediately apparent.

Below is the result of an actual test run by one of the country's leading manufacturers of automobile accessories.

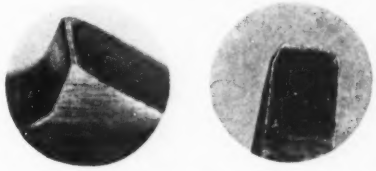
The ability of DoALL DEMON saw bands to maintain their sharpness through tough, tortuous sawing when other blades fail, stems from the fact that these saw bands retain full hardness even with red heat (about 1000°F.) in contrast to carbon steel which begins to lose its hardness at about 400°F.

Shown at the right are two 30X photomicrographs comparing the condition of the set tooth tips of DEMON and carbon steel saw blades after making ten cuts in 3240 tool steel, hardened to 40-42 Rockwell C. In both cases the same feed and blade velocity were used.

DoALL DEMON Saw Bands in Precision and Buttress types are available in cut and welded lengths in the width-pitch combinations shown at the right. Details available on request.



Carbon Steel After 10 Cuts



Demon After 10 Cuts

TYPE	BUTTRESS			PRECISION		
PITCH	2	3	4	6	8	10
1/4"						√
3/8"						√
1/2"			√			√
3/4"		√		√	√	√
1"	√	√		√	√	√

Comparison DoALL Demon vs Carbon Blade

	DoALL DEMON saw band		Carbon Steel saw bands	
No. of blades used	1.0		4.2	
Cost per blade	$19.73		$2.77	
Total blade cost		$19.73		$11.73
Total sawing time (setup time not included)	1.8 hrs.		20.6 hrs.	
Tool room saw rate	$4.00/hr.		$4.00/hr.	
Total saw time cost		$7.20		$94.13
Total cost for sawing 55½" Timken Alloy (not including setup cost)		$26.93		$105.86

Savings: $78.93 (not including setup time)

DoALL FILES for Every Job

American and Swiss Pattern Hand Files • Rotary Files and Burrs

DoALL Band Files — Fastest Filing for Internal and External Finishing in the World

Call DoALL see classified directory for Service-Store stocking files, cutting tools, gages, supplies . . . Or Write: THE DoALL COMPANY DES PLAINES, ILL.

22

For Your Best Buy in a Magnetic Chuck

Call DoALL

MAGNA-LOCK CHUCKS

- For every job, heavy or light
- Rectangular
- Rotary
- Swiveling
- Vertical
- Sine
- Special

Superior holding power

Moisture-proof

Shock-proof

Call DoALL see classified phone directory for nearest DoALL Service-Store—complete stock of gages, cutting tools, supplies. Or Write THE DoALL COMPANY Des Plaines, Ill.

26

MAKE YOUR OWN PRECISION GAGES with DoALL MICRO-STEP GAGING SYSTEM

Save money—Assemble unlimited different gages for shop and lab, using gage blocks and unique new Micro-Step Accessories.

FREE DEMONSTRATION

Consult your yellow Directory for location of nearest of the thirty-eight DoALL Sales-Service Stores that stock complete metal working necessities.

End Standards

Holders

Gage Blocks

Call or Write The DoALL Co. Des Plaines, Ill.

5

For PRODUCTION TAPPING AT ITS BEST

Use DoALL "Engineered" Taps

- Complete stocks
- All kinds . . . all sizes
- High speed steel
- Special taps for special needs

Guaranteed

None Finer

Call DoALL see classified directory for nearest DoALL Service-Store carrying complete stocks cutting tools, gages, supplies.

The DoALL Co. Des Plaines, Ill.

17

HOLLOW-FRAME MICROMETERS Reduce Gaging Errors

Up to 50% less weight • Lessens fatigue, assures accurate gaging, better balance and feel • Minimizes expansion and contraction

Hollow-Frame Construction

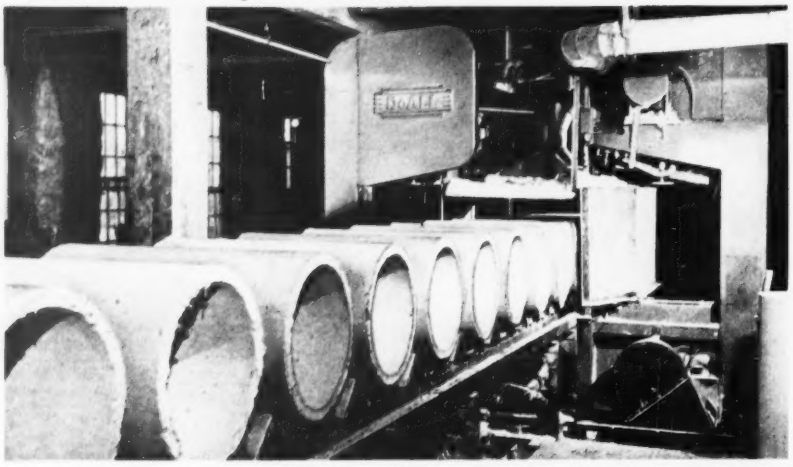
Call DoALL see classified phone directory for nearest of 38 DoALL Service-Stores that stock gages, cutting tools, supplies—Or Write The DoALL Co. Des Plaines, Ill.

Sizes up to 96"

23

—See Next Page—→

DoALL's Trim Pipe Insulation Automatically



At Ehret Magnesia Corporation, Valley Forge, Pa., special DoALL Band Machines slice 85% magnesia insulation material in preparation for stacking and boxing. The photo shows how both ends are trimmed simultaneously. Pieces are then passed on to another DoALL to be cut down the center to form semi-circular lengths.

Free Demonstrations

A "see-before-you-buy" service is offered to customers by all DoALL stores. Any cutting tool, gage, machine tool or supply item will be demonstrated at any plant free of charge upon request. Additionally, DoALL men carry color stereo slides showing applications of DoALL band machines and surface grinders to enable industrial buyers to better visualize use of the equipment. Motion pictures are available for group showings.

Sawing, Gaging Texts

The DoALL Band Tool Manual, a 160 page text explains selection and use of saw bands and other band tools for every purpose. Terminology, diagrams and selection tables included. Price $2.00.

The Science of Precision Measurement, a 264 page text explains the need and application of gage blocks, optical flats and other accessories for millionths-inch accurate quality control. Price $3.50.

You Can Cut Cost Per Hole with DoALL Reamers because:

1. Special processing gives more holes per grind.
2. Faster feeds can be used.
3. DoALL stocks more sizes and types than anyone else — "specials" with others are standard at DoALL.

Call DoALL—see classified directory for nearest DoALL Service-Store. Cutting tools, gages, tool steel, supplies in stock.

Or Write:

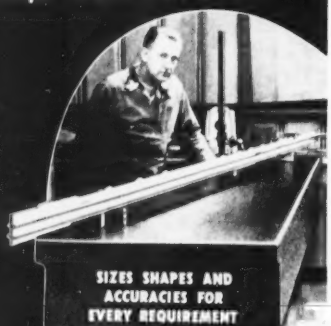
The DoALL COMPANY

Des Plaines, Illinois 18

DoALL Granite SURFACE PLATES

Non-Rusting • Non-Magnetic • Utmost Accuracy • Cheaper Than Metal Plates

- Wear Free
- Shock Proof
- Harder than hardened steel
- Velvet Smooth
- Unsurpassed for Production, Inspection and Layout Work



Consult your yellow Directory for location of nearest of the thirty-eight DoALL Sales-Service Stores that stock complete metal working necessities.

Call Your DoALL Service-Store

Machine Tools • Cutting Tools • Measuring Instruments • Shop Supplies • In Stock

The DoALL Company, Des Plaines, Ill.

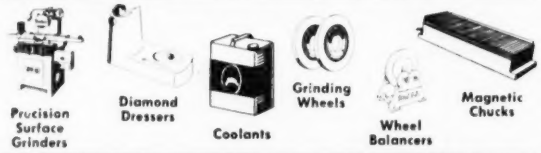
DoALL GRINDING RESEARCH Helps You Get Better Results

Magnified view of chips produced on surface grinder using no coolant. Intense heat caused melting, formed globules. Such heat checks, warps work.

Magnified view of chips produced on DoALL Surface Grinder on which coolant goes through the wheel. Heat is dissipated, burning prevented.

Ask to see new DoALL color, sound film "Techniques of Surface Grinding." For showings to groups. Call your DoALL Store.

DoALL



33 The DoALL Company, Des Plaines, Ill.

Vol. 3—No. 2—65M—4 54

PRINTED IN U.S.A.

BEVEL and Mitre Gears

To make the best bevel and mitre gears — the largest battery of No. 24 Gleason Bevel and Mitre gear generators* in the world — operates in the Illinois Gear & Machine Company's plants.

This is another of the many reasons why "Illinois Gear" is the World's largest producer of high quality gears of every type.

*All of these generators cut "CONIFLEX" tooth form.

ILLINOIS GEARS Reg U S Pat Off

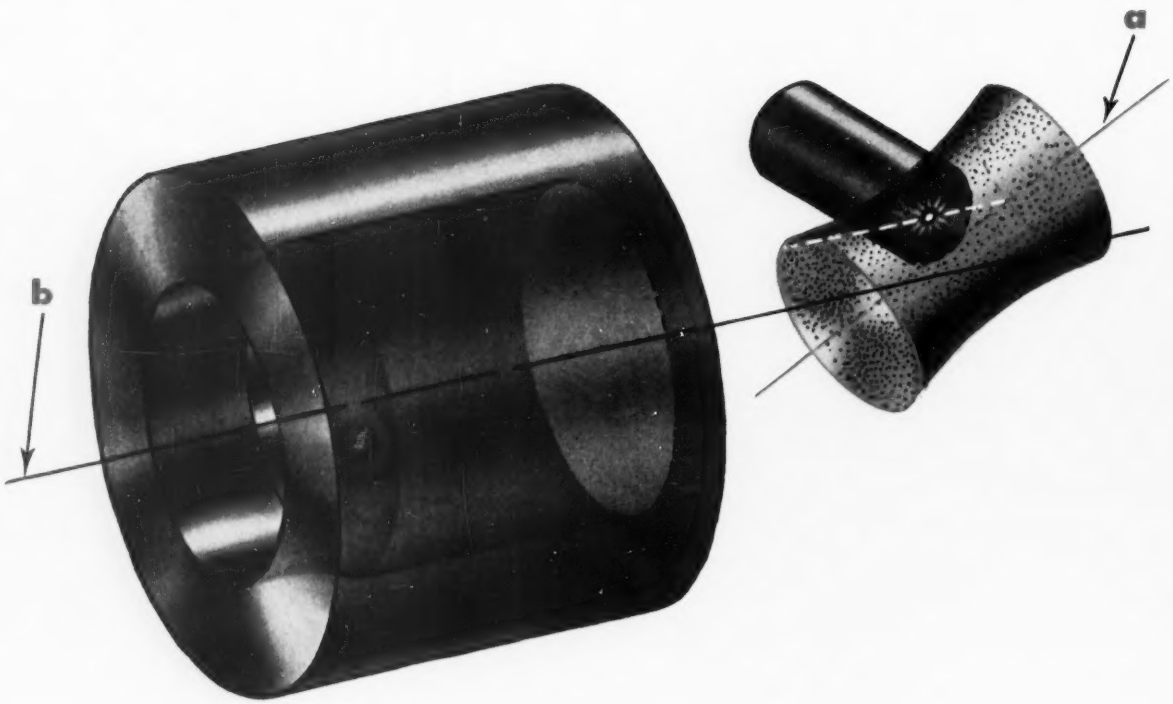
Gears for Every Purpose ... one gear or 10,000 or more

ILLINOIS GEAR & MACHINE COMPANY

2108 NORTH NATCHEZ AVENUE • CHICAGO 35, ILLINOIS

alignment

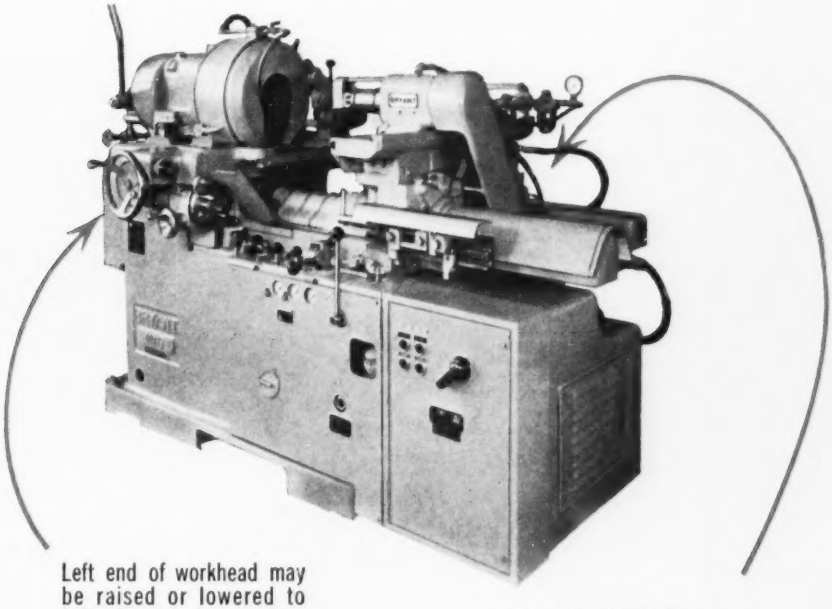
for better internal grinding



IT is generally believed in internal grinding that once the grinding wheel passes the diamond, the form of the wheel will be a perfect cylinder. In our illustration the wheel is tipped as it passes the diamond and an hourglass form is generated on the wheel. This condition is not peculiar to an internal grinder. The same form is generated in turning an O.D. on a lathe if the tailstock is either high or low.

The path of the diamond is a straight line across the surface of the wheel, but the wheel will not contact the work on the same straight line. Contact may be at a point on each end of the wheel. Since the wheel does not contact across its full face, wheel wear will be excessive and the wheel will act soft.

The geometry of the hole may be upset as in the illustration, with the result that the back of the hole will be tight. Neither turning the workhead nor changing the length of traverse will correct this error. Because the wheel is contacting at either one or two points, instead of a straight line, the surface finish will be poor. The remedy is to correct the alignment by bringing the wheel center line "a" parallel with the path of the wheel and in plane with the work center line "b".



Left end of workhead may be raised or lowered to bring its axis into a plane parallel with the wheel path.

Rear of wheelslide may be adjusted to insure straight line motion of the wheel.

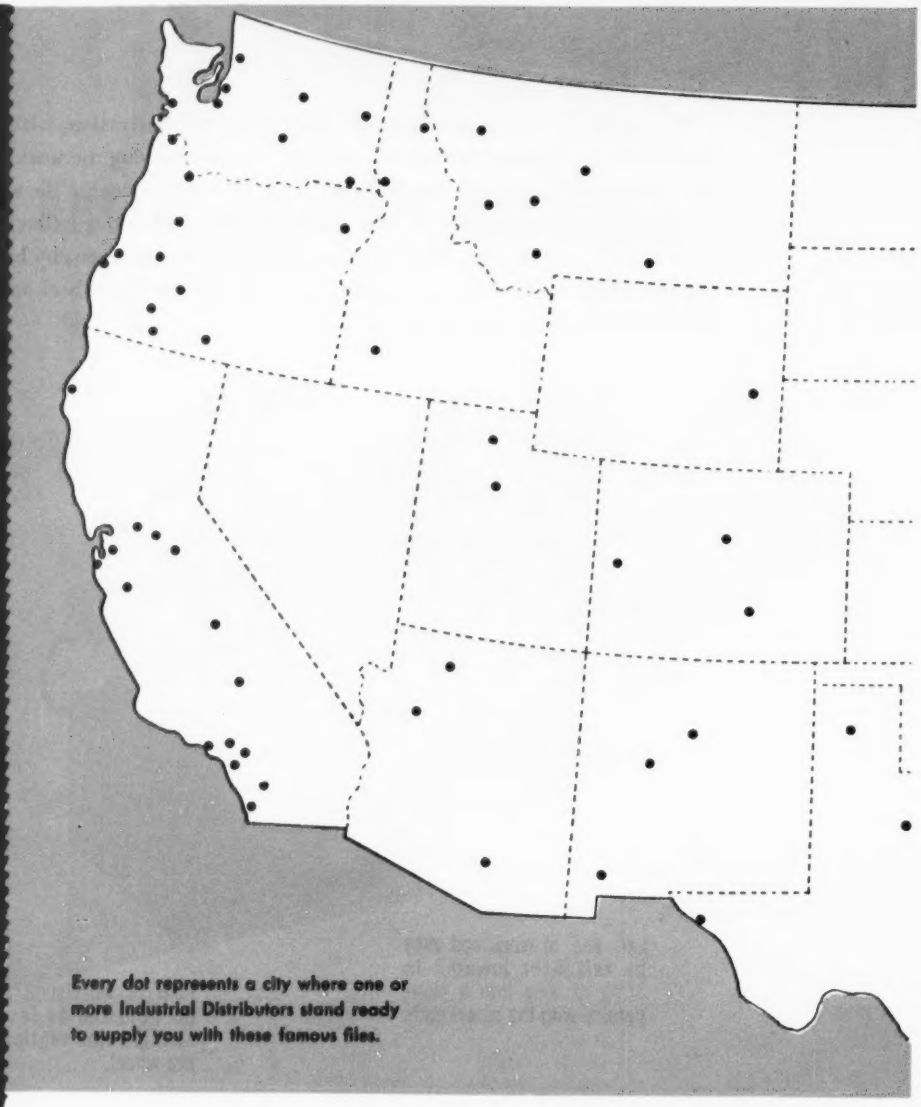
This machine is for general purpose hole grinding. It has convenient centralized controls and all features necessary to handle a variety of work with minimum time and effort needed for changing jobs. For stable 3-point support, the wheel spindle is mounted on a cylindrical bar which is supported on 2 cylindrical bearings. The rear of the slide is supported on a hardened and ground guide plate. Workhead may be swiveled for grinding tapers up to 90° included angle. Provision is made for mounting a face grinding spindle in addition to the hole grinding spindle. The No. 1116 will swing 16″ with 12″ max. hole depth. Write for folder.

Write for "Alignment" booklet which gives complete details on this interesting subject. Also ask for booking form on new sound, color movie — free showings arranged for engineering groups.

Bryant Chucking Grinder Co.

Springfield, Vermont, U. S. A.

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates



Every dot represents a city where one or more Industrial Distributors stand ready to supply you with these famous files.

A DISTRIBUTION SERVICE

Nicholson and Black Diamond files are handled by one of the largest and most widespread groups of Industrial Distributors serving American industry.

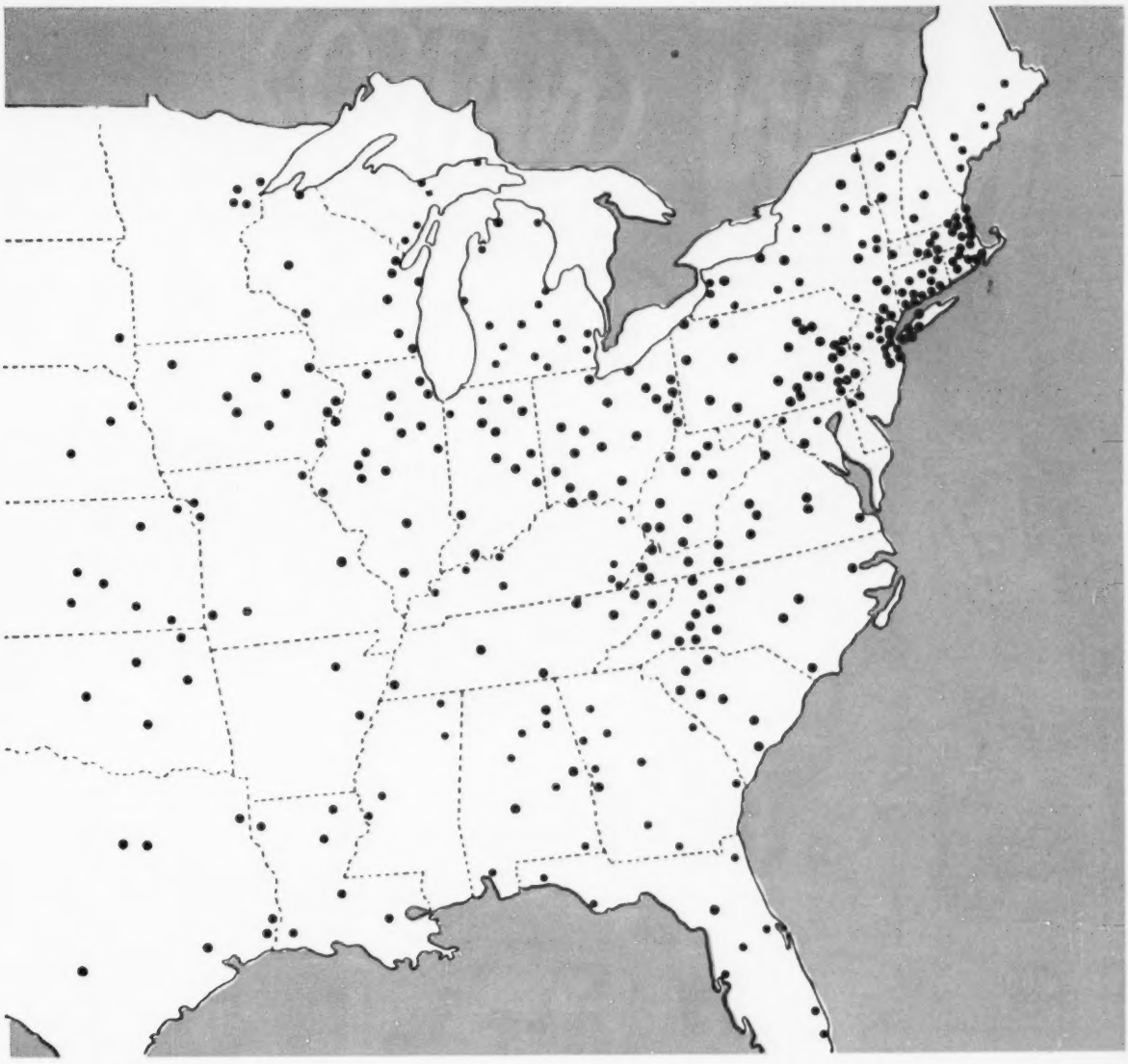
They can serve you no matter where you are located.

To you managing, purchasing and production heads, Nicholson and Black Diamond distribution is measured in terms of *Availability*, *Knowledge* and *Facilities:*

1. There are Nicholson and Black Diamond distributors in the 396 cities indicated above—a complete network.

2. They are all high-type distributors with well-trained, competent salesmen.

NICHOLSON



THAT COVERS THE NATION

Thus the Nicholson and Black Diamond distributor representative serving you is a useful technical consultant instead of just an order taker.

3. They have the means for maintaining good stock assortments.

4. They have efficient delivery facilities.

5. They rate high in intimate knowledge of the file requirements for different industries, different metals, different shop operations.

Nicholson products include every practical shape, cut and size in Regular Purpose, Special Purpose, Saw, Milled Curved Tooth, Swiss Pattern and Rotary files—the largest aggregate in existence.

NICHOLSON FILE COMPANY

PROVIDENCE 1, R. I.

(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

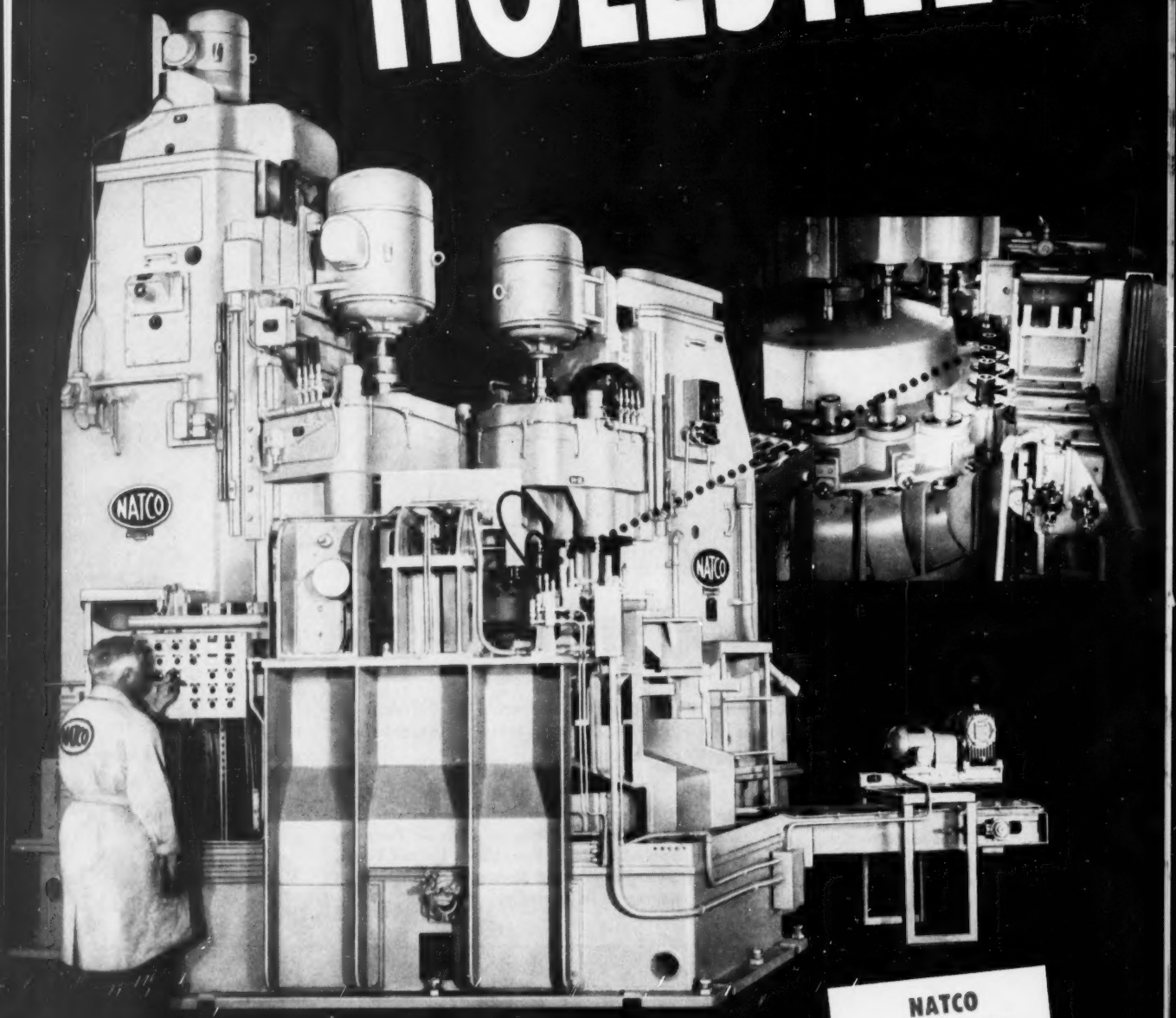
NICHOLSON U.S.A.

BLACK DIAMOND MADE IN U.S.A.

...A FILE FOR EVERY PURPOSE

A DISTRIBUTOR FOR EVERY USER

NEW NATCO HOLESTEEL



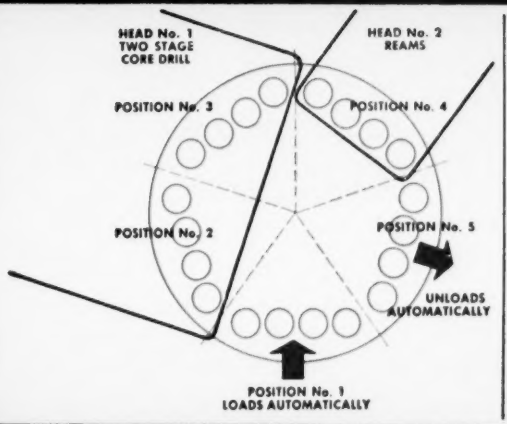
. . . THIS IS ANOTHER MACHINE

NATCO ENGINEERED
for quality and quantity production

CUTS TRACK LINK BUSHING COSTS!

AUTOMATICALLY CORE DRILLS and REAMS SIX DIFFERENT SIZES UP TO...

400 PARTS per HOUR!



FIVE POSITION INDEXING TABLE WITH 20 CHUCKS, AUTOMATIC LOAD and UNLOAD

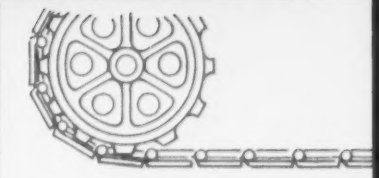
POSITION No. 1
Automatically loads four bushings . . .

POSITION No. 2
Core drills halfway through . . .

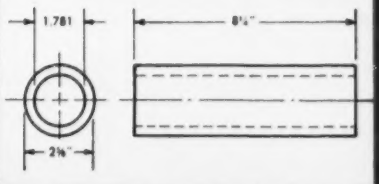
POSITION No. 3
Core drills through . . .

POSITION No. 4
Reams through to size . . .

POSITION No. 5
Automatically unloads four bushings.



TRACK LINK BUSHING



This new NATCO HOLESTEEL automatic indexing machine core drills and reams six different size bushings ranging from 5" to 8¼" in length, 2⅛" to 2⅝" O.D. and 1.4375" to 1.781" I.D. at the rate of from 270 to 400 per hour estimated gross production. The production depends upon the size bushing being run. Estimated gross production is based on 85% of maximum capacity. The stock from which these parts are made is seamless steel tubing and approximately 1/16" of stock is removed in this core drilling and reaming operation.

Call a Natco Field Engineer

to help you solve your problems in Drilling, Boring, Facing and Tapping.

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

Branch Offices

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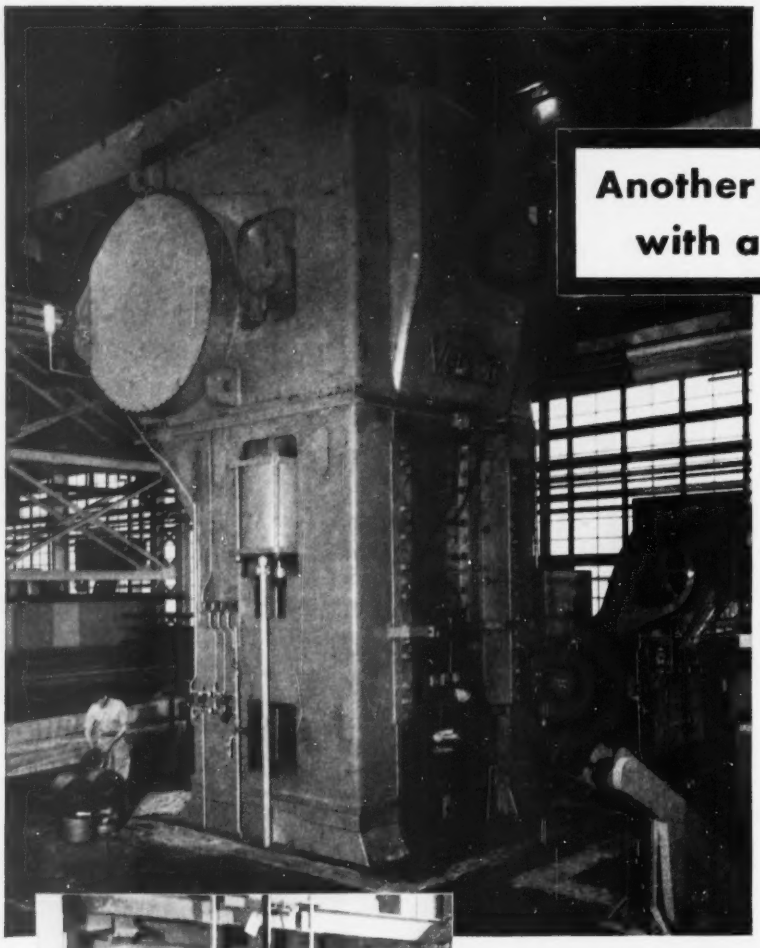
BUFFALO, 1807 Elmwood Ave. • NEW YORK, 35 Beechwood Ave., Mount Vernon



Another job done better with a Verson press

THIS Verson 2500 TON FULL ECCENTRIC PRESS forms automotive flywheels

Close-up of the die space in this 2500 ton Verson Full Eccentric Press showing the part being formed.

If you want to combine the highest standards of accuracy and uniformity in stampings with long, dependable, trouble-free press life, a Verson Full Eccentric Press is the answer. Verson Full Eccentrics incorporate the sum of over thirty years' experience in the manufacture of rugged high strength presses designed to produce better stampings at lower cost.

Such features as the Verson Allsteel Frame . . . the Verson full eccentric drive . . . straight thrust eccentric strap . . . extra long, barrel type, non-oscillating vertical adjusting screw . . . anti-overlap clutch and brake unit put Verson Full Eccentrics in a quality class by themselves.

The press shown above is typical of Verson Full Eccentric Presses. It is being used to form heavy flywheels on a high production basis. Note the long, extra heavy special gibbing and rugged construction throughout—assurance of the accuracy and uniformity required in a part like this.

The Verson Full Eccentric line includes models with one, two and four point suspension in capacities from 100 tons up. Further data is given in Catalog G-52. Write for your copy.

A Verson Press for every job from 60 tons up.

Verson

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

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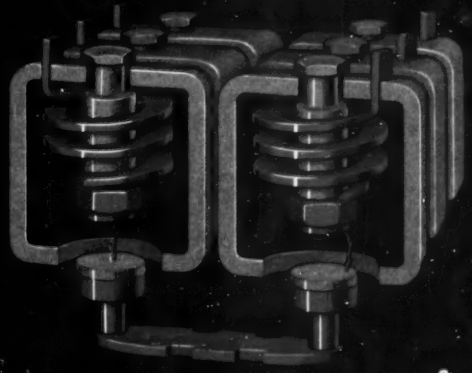
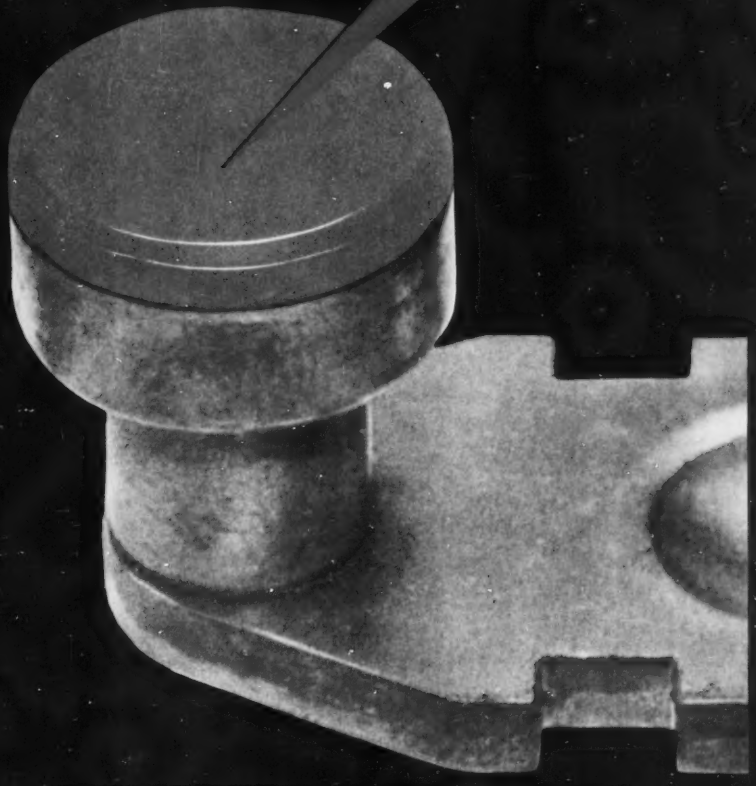
MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

For more information on products advertised, use Inquiry Card, page 247

CONTROLLED LIGHTNING

CLARK Type "CY" AC MAGNETIC STARTERS effectively control the millions of miniature lightning flashes (arcs) which bombard the contact tips—to prevent burning, pitting or build-up at any one point. This is accomplished by the use of strong multi-turn magnetic blow-outs and double-break contacts. Forced rotation causes the arc to move continually over contact surfaces to distribute the heat. Moreover, the magnetic field tends to quench the arc by either lengthening or confining it. Result: contact tips never require filing, dressing or cleaning and you get more dependable performance and longer contact life with less maintenance.





CLARK Type "CY" Starters offer many other advantages. Steel arc chambers are non-carbonizing—The solid top construction limits ionized gases between wiring terminals. Cabinets are designed to provide ample wiring space for easy installation. No tools are required to inspect contacts. All contacts as well as other components which may require service are quickly and easily accessible for inspection, removal and replacement.

THE CLARK CONTROLLER CO.

ENGINEERED ELECTRICAL CONTROL

1146 EAST 152nd STREET, CLEVELAND 10, OHIO

See reverse side for range of sizes, enclosures and combinations.

CLARK type "CY" AC MOTOR STARTERS

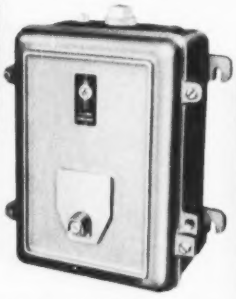
available in sizes, combinations and enclosures

TO MEET YOUR REQUIREMENTS

SIZES: 0, 1, 2 and 3. Sizes 2 and 3 employ the new "CY" arc interrupting principle

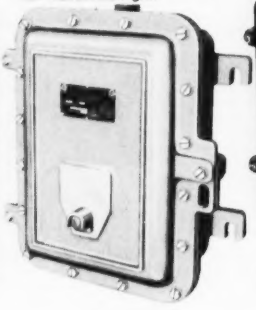
BASIC Across-The-Line STARTER

NEMA Type 1
General Purpose

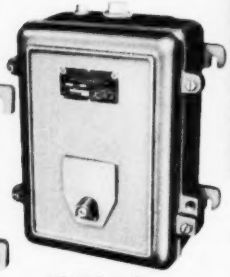


NEMA Type 4
Water-tight

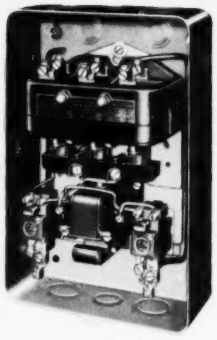
NEMA Type 5
Dust-tight



NEMA Type 7
Explosion Resisting
for hazardous gas



NEMA Type 9
Explosion Resisting
for hazardous dust



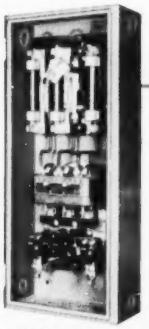
Open view — showing accessibility and generous wiring space

TYPES OF ENCLOSURES

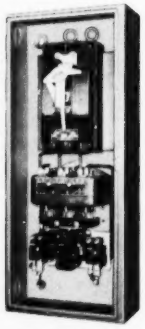
COMBINATION STARTERS

NEMA Type 1
General Purpose

NEMA Type 1A
Semi-Dust-tight



Bulletin 6018 Combination AC Magnetic Starter, with Fusible Disconnect Switch.



Bulletin 6020 Combination AC Magnetic Starter with Air Circuit Breaker.

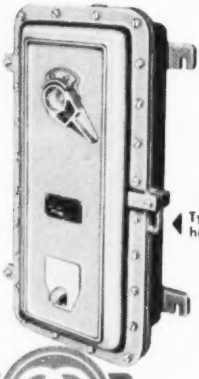
TYPES OF ENCLOSURES

A WIDE VARIETY OF MODELS

are available for every application within their horsepower limits.

NEMA Type 4
Water-tight

NEMA Type 5
Dust-tight



NEMA Type 7 for hazardous gas

NEMA Type 9 for hazardous dust

NEMA Type 12
Industrial Type

THE CLARK CONTROLLER COMPANY
1146 EAST 152nd STREET • CLEVELAND 10, OHIO

Please send me 8-page descriptive literature on Clark Type "CY" Starters.

NAME

COMPANY

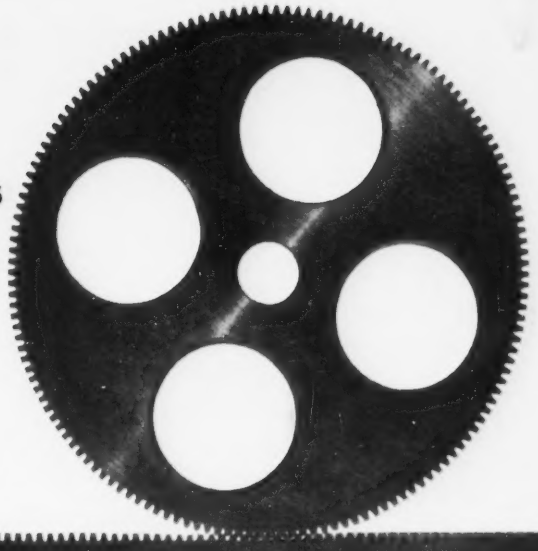
TYPE OF BUSINESS

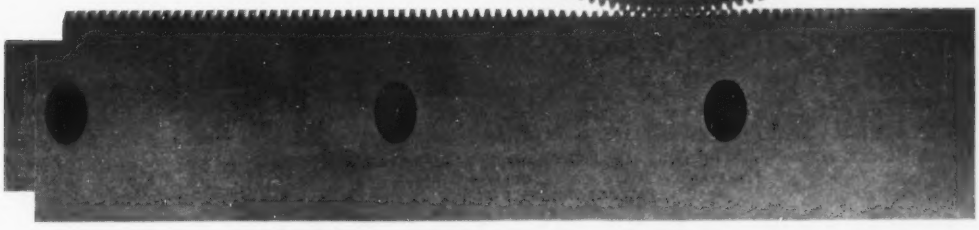
ADDRESS

CITY AND STATE

Use this coupon for obtaining complete information on CLARK Type "CY" AC Motor Starters with the revolutionary new arc interrupting principle.

Here's *Why* you can check precision gears *more conclusively* with Kodak Conju-Gage Gear Checkers

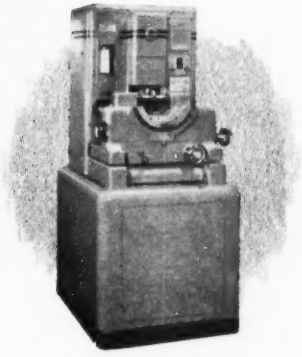




Why the composite check

Errors in gears seldom occur individually—they're usually combinations of as many as six types of errors. The practical way to test gears for these errors is to test them in action through the composite check recommended in the new American Standard (AGMA 236.02; ASA B6.11-1951).

This check measures gear errors as variations in center distance when the gear is rotated in contact with a master of known accuracy. Since this variation is the sum of errors in both gear and master, the degree of precision measurable depends on the precision of the master.



The Kodak Conju-Gage Gear Checker automatically records the composite effects of runout, base pitch error, tooth thickness variations, profile error, lead error, and lateral runout. Illustrated is the Kodak Conju-Gage Gear Checker, Model 4U, for gears up to 4⅛" pitch diameter. Larger and smaller models are also available.

Why the Conju-Gage Gear Checker

Kodak Conju-Gage Gear Checkers use a master of exceptional accuracy, the Kodak Conju-Gage Worm Section. These Worm Sections are generated by the continuous action of a thread grinder under control of a precision lead screw—circular pitch error and tooth thickness variations cannot be introduced by defects in an intermittent indexing mechanism. This means a more accurate gaging element, less chance that error in the master may coincide with a tolerable error in the gear to result in a needless rejection. Less chance, too, that an error in the master may subtract from an intolerable error in the gear, passing a gear that will fail in use.

By passing each right gear, rejecting each wrong gear, the Kodak Conju-Gage Gear Checker helps you reduce costs while maintaining highest precision. For the full story of this and other economies achieved by Conju-Gage instrumentation, send for the booklet, "Kodak Conju-Gage Gear Testing Principle." Write to:

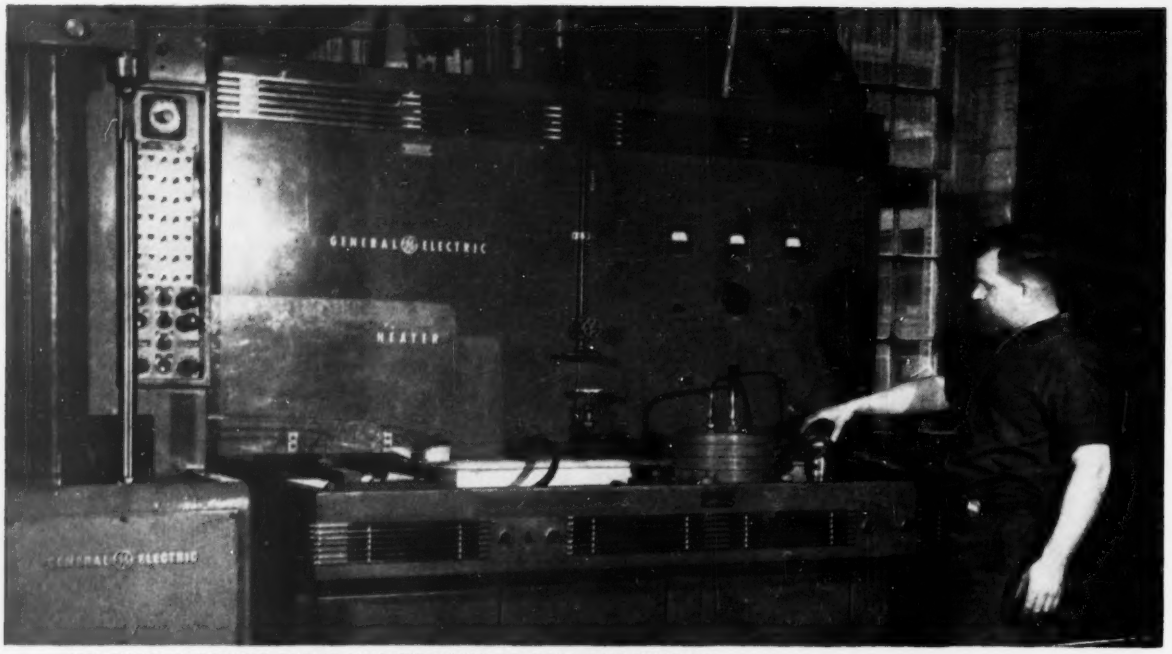
Special Products Sales Division
EASTMAN KODAK COMPANY, Rochester 4, N.Y.

CONJU-GAGE INSTRUMENTATION

. . . a new way to check gear precision in action

To inspect all kinds of complex parts on a bright screen, Kodak also makes two highly versatile contour projectors.

Kodak
TRADE-MARK



INDUCTION HARDENING TEXTILE-MACHINE PARTS AT WHITIN MACHINE CO.

Hardening Output Increased Ten Times With G-E Induction Heaters

"Since changing to General Electric induction heaters for hardening twister rolls we've increased our hardening output ten times and improved product quality!" reports Arno Wagner, heating engineer, Whitin Machine Co., Whitinville, Mass.

When using cyanide furnaces for hardening, it took Whitin 3½ hours to harden only 11 rolls. Now, by applying selective G-E induction heat, Whitin hardens over 35 rolls per hour! Because parts require no expensive preparation for heating—necessary with furnace hardening—Whitin has reduced costs significantly. Hardness tests show induction-hardened rolls to be stronger and of more uniform hardness.

Improved working conditions are another benefit now enjoyed by Whitin, because compact G-E heaters eliminate the discomfort of radiant heat and provide cleaner, more comfortable working conditions.

Included in Whitin's heating operation are one 50-kw and three 20-kw G-E heaters. Used primarily for hardening over 500 parts for textile machines, these versatile heaters are also applied for annealing, soft soldering, and silver soldering. In each case, substantial savings in time and money have resulted.

This high-quality selective heating at lower cost is available to you. To learn how you can profitably apply G-E induction heat to your operations, contact your G-E Apparatus Sales representative. And write now for bulletins on G-E induction heaters to General Electric Co., Section 720-118, Schenectady 5, N. Y.

PROGRESSIVE HARDENING twister roll in this G-E fixture is done automatically at the rate of two inches per second.

SURFACE HARDENING machine part is a fast process. Only 20 seconds are required to harden, quench, and remove part.

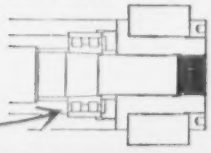
You can put your confidence in—

GENERAL ELECTRIC

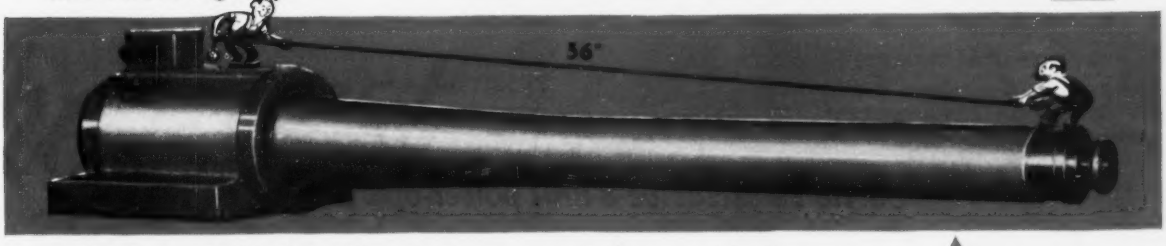
For more information on products advertised, use Inquiry Card, page 247

YOU CAN *Specify* POPE PRECISION SPINDLES WITH CONFIDENCE

TAKE THESE DEEP HOLE SPINDLES, FOR EXAMPLE

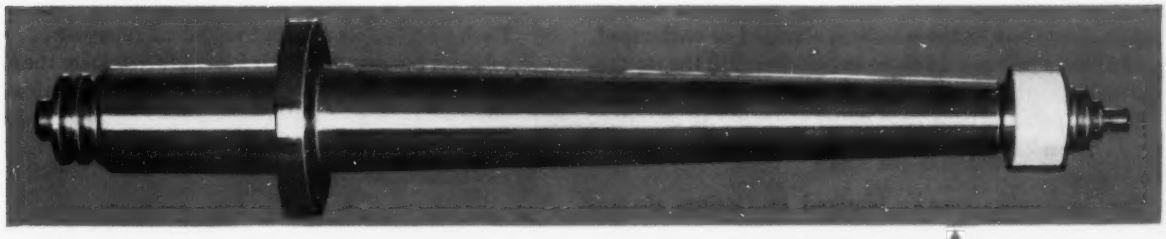


Only POPE Deep Hole Spindles are equipped with tapered bore, double row, cylindrical roller bearings close to the wheel for maximum rigidity.



Pope P-5886 Motorized Deep Hole Spindle — 75" overall length, 4" barrel diameter at the wheel end, 6" at the motor end

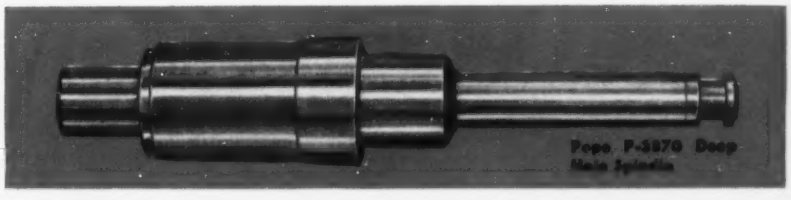
POPE Deep Hole Spindles produce more holes per day because they can take heavy cuts; superior finished holes due to their shaft and bearing construction and Pope precision craftsmanship. Pope Spindles are dynamically balanced with all rotating parts in full assembly to insure smooth running and good grinding results.



Pope P-16022 Belt Driven Deep Hole Spindle

LUBRICATION — Pope System. The bearings are permanently lubricated for their entire operating life and require no further attention.

— an actual comment made by the operator of a Pope Deep Hole Spindle to a shop inspector.



Pope P-5870 Deep Hole Spindle

Ask for detailed specifications and prices on Pope Heavy Duty Deep Hole Precision Spindles.

No. 98

Specify **POPE** PRECISION SPINDLES

POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET • HAVERHILL, MASSACHUSETTS

Carlton *Only one*

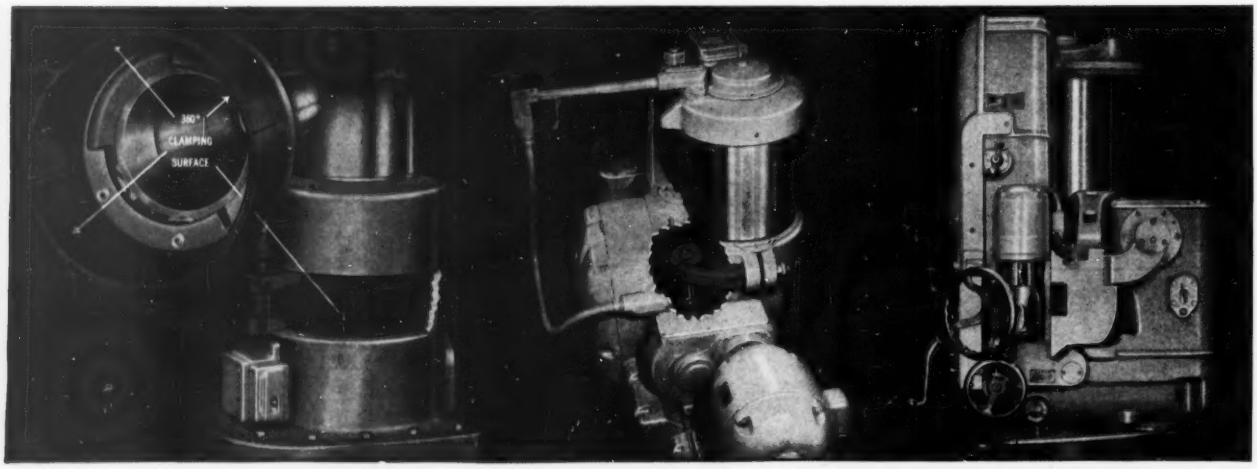
Carlton's exclusive 3-unit power-operated mechanical clamping of arm, head and column is easier, faster and costs less to operate

ELECTRO-HYDRAULIC POWER is used to actuate mechanical clamping devices on arm, head and column of Carlton radials. Once any of these units is clamped or unclamped, mechanical devices hold them in position until the electro-hydraulic power is applied again.

Electric power is used only when clamping or unclamping . . . results in noticeable savings in electric power consumption.

The hydraulic pressure required in Carlton electro-hydraulic clamping systems is comparatively low . . . so that there is positively no leakage of oil from any unit. Each unit has its own individual oil reservoir . . . and the oil from the Arm reservoir is used to lubricate the Column.

Due to the use of electrical interlocking, overload relays and safety valves, it is impossible to overload Carlton electro-hydraulic clamping systems either electrically or mechanically.

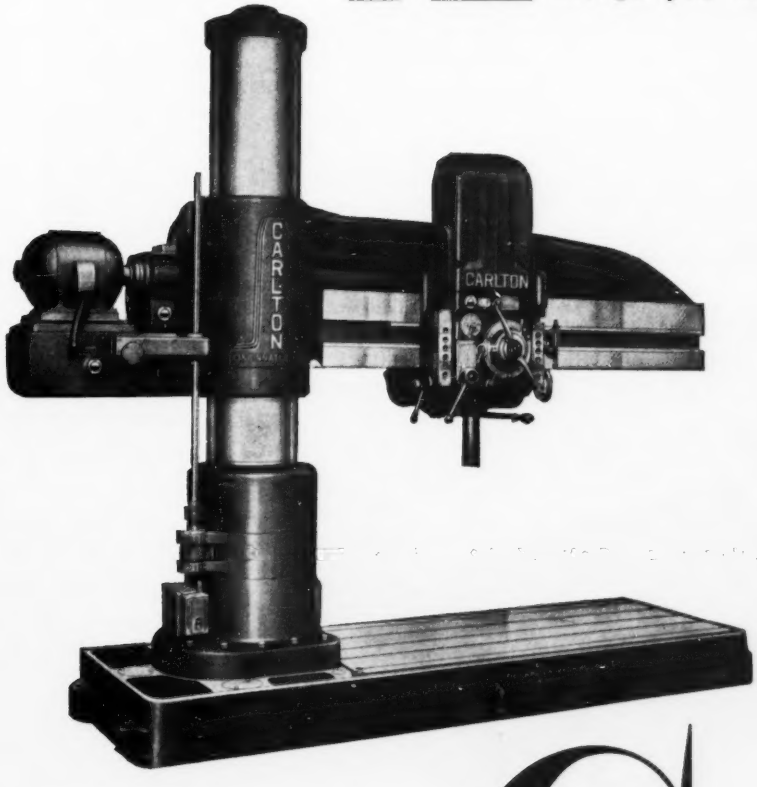


column clamp...arm clamp...head clamp

can be called the finest . . .

CENTRALIZED CONTROLS:
All controls necessary for quickly and accurately locating the drill from one hole to the next are centralized at the head . . . all located within the spread of a man's hand.

only Carlton brings you all three radial drill advantages:



- **CENTRALIZED CONTROLS** (see above).
- **3-UNIT POWER CLAMPING:** column, arm, head (see opposite page).
- **LOW HUNG DRIVE** . . . drives on largest diameter of the spindle . . . permits maximum torq transmission with a minimum of spindle twist.
- **FREE AND EASY RUNNING** . . . thanks to the generous use of tapered and straight roller bearings and ball bearings.
- **EASY TO MAINTAIN** . . . parts jig machined for absolute interchangeability.
- **THE RIGHT RADIAL** for you: select your Carlton from among 5 models, 26 different arm and column sizes. Why not send for descriptive bulletins today?

Carlton

THE CARLTON MACHINE TOOL CO., CINCINNATI 25, OHIO

ARMSTRONG

Use the Correct . .

ARMSTRONG TOOL HOLDERS

to increase pieces, production and profits!

Because they do their work so well, without repairs, maintenance or replacement . . . because they last for years and have become as much a part of everyday operations as steel itself, the importance of using the correct type and size ARMSTRONG TOOL HOLDER for each operation, is frequently overlooked. It should always be remembered that by controlling the cutting point, ARMSTRONG TOOLS control both the productivity and efficiency of every lathe, planer, slotter, and shaper in most shops.

Tools so vitally situated, no matter how trouble-free, deserve periodic checking . . . checking to see that the correct size and correct type ARMSTRONG TOOL HOLDER is being used for each operation: checking to be sure that you are taking full advantage of the newer additions to the Armstrong System—the special types for ARMIDE (Carbide Tipped) Cutters, others for ARMALOY (Cast Alloy) Bits and Blades; the newer "spring" form threading tools and cutting-off, etc., etc.

Write for a recent ARMSTRONG Catalog and check your tooling of each operation.

ARMSTRONG BROS. TOOL CO.

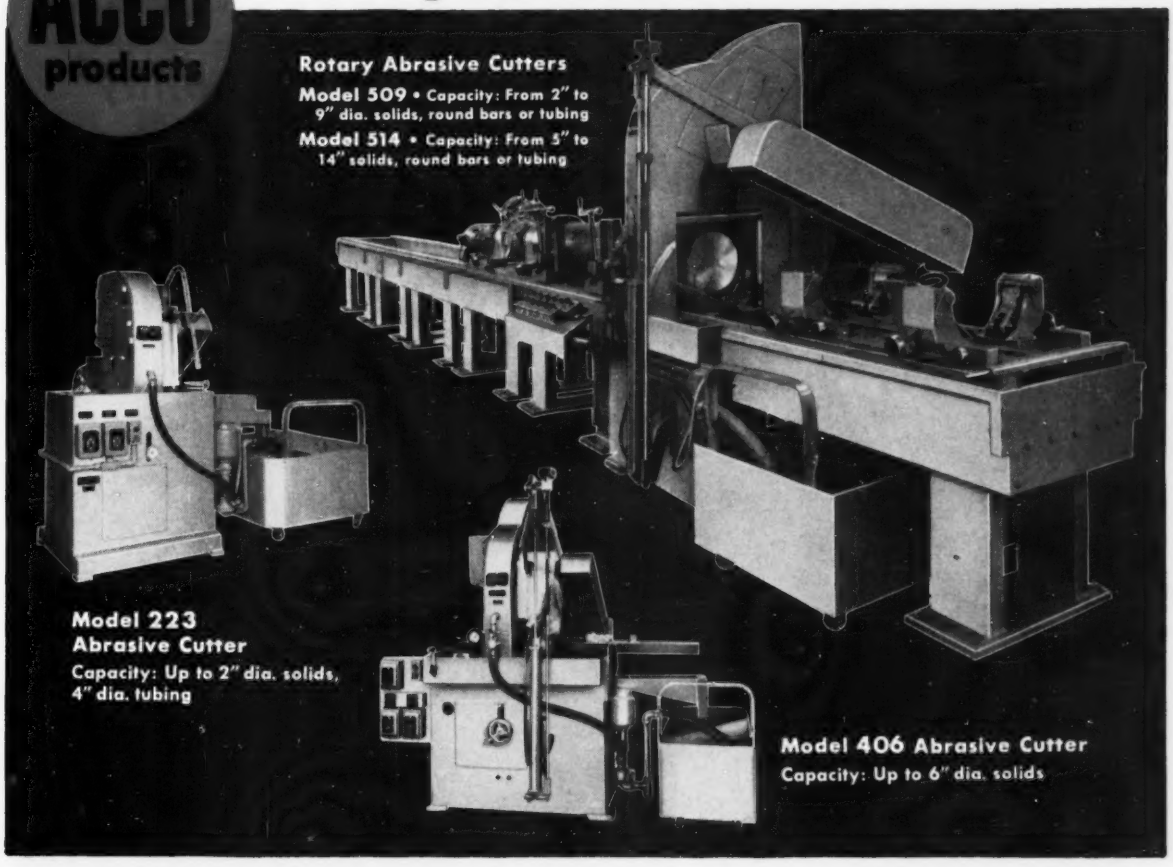
"The Tool Holder People"

5213 WEST ARMSTRONG AVENUE • CHICAGO 30, ILLINOIS

For more information on products advertised, use Inquiry Card, page 247

Campbell Abrasive Cutters

ACCO products


Rotary Abrasive Cutters
Model 509 • Capacity: From 2" to 9" dia. solids, round bars or tubing
Model 514 • Capacity: From 5" to 14" solids, round bars or tubing
Model 223 Abrasive Cutter
Capacity: Up to 2" dia. solids, 4" dia. tubing
Model 406 Abrasive Cutter
Capacity: Up to 6" dia. solids

Quick cut-offs save you money—here's how . . .

By rapidly cutting stock that takes much longer by other cutting methods, CAMPBELL Abrasive Cutters reduce your labor costs and the number of machines required. They make quality cuts on alloy and high carbon steels. Close tolerances, smooth finish and straight cuts can be made, resulting in large savings of material. Cuts all types of stock without hardening and with minimum of burr.

It will pay you to remember these CAMPBELL features:

1. Superior Sales Engineering Service
CAMPBELL engineers, experienced in every type of cutting problem, are available for consultation on YOUR cutting problems.

2. Economy and Speed of Operation
CAMPBELL Abrasive Cutters are built to do every type of cutting job with the utmost accuracy, efficiency and economy. Cuts are smooth and practically burr free.

3. Complete Line of Standard Machines
CAMPBELL Abrasive Cutters are available in the widest variety of styles and models. They are fully automatic and semi-automatic. Have many exclusive features. . . .

Consultation with trained CAMPBELL engineers will cost you nothing. Let them show you how the addition, or substitution, of the right abrasive cutter can increase your output per man-hour. It could be the most profitable move you ever made.

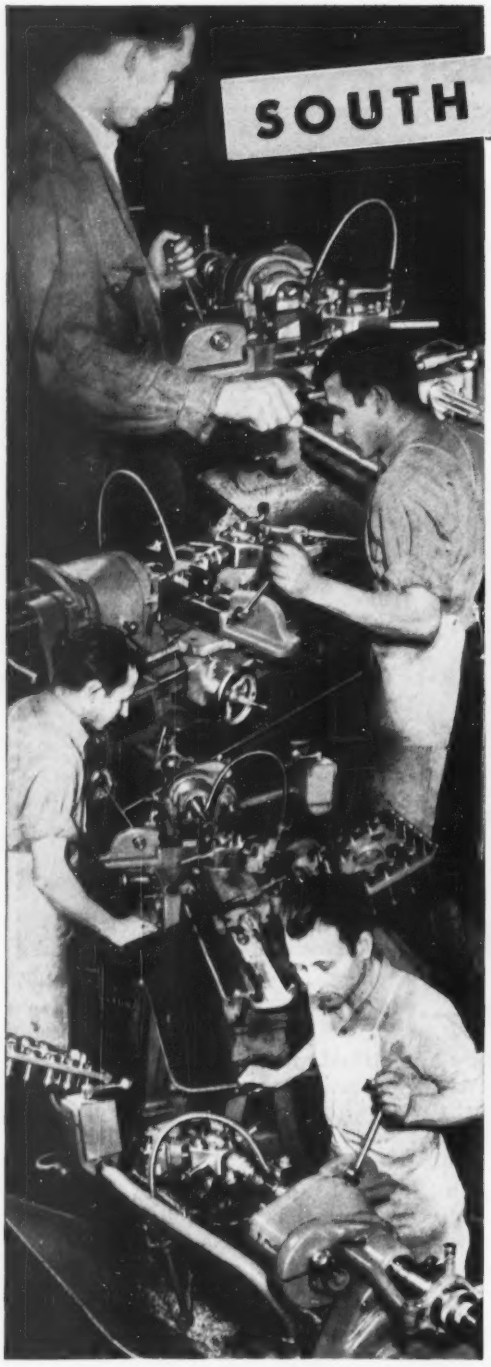
Write today for Bulletin DH-301 on Campbell Abrasive Cutting Method

ACCO

Campbell Machine Division
AMERICAN CHAIN & CABLE

925 Connecticut Avenue, Bridgeport 2, Connecticut

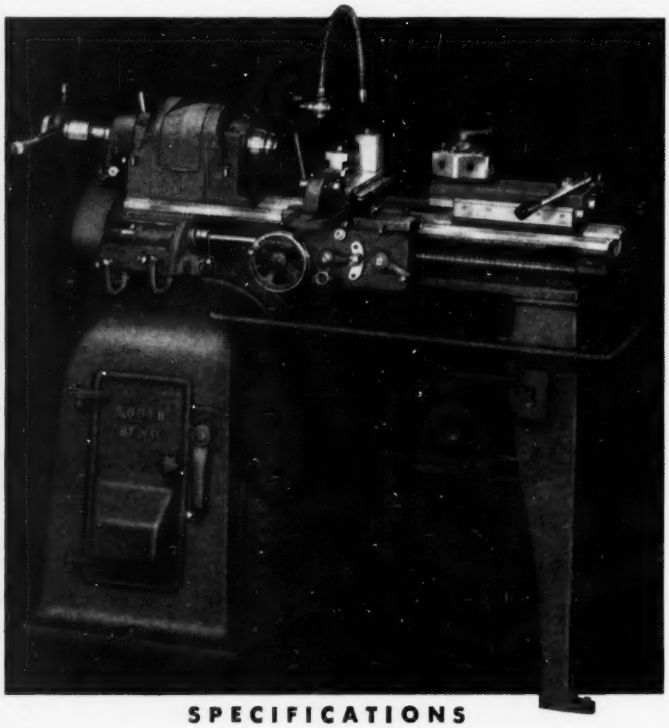
Wet and Dry Cutters and Nibblers



SOUTH BEND 1000 TURRET LATHE

Cost-Cutting Versatility

This precision turret lathe will cut your machining costs on small parts. Built-in accuracy, ease of operation and a wide range of speeds and feeds insure high production and close tolerances. Practical attachments simplify tooling the lathe for jobs which might otherwise require special fixtures. What's more, your least experienced operator will soon be a top producer on the 1000 Turret Lathe — it's that easy to run. Find out how this versatile turret lathe can improve your machining — *send coupon now.*



SPECIFICATIONS

Swing	10-1/8"
Turret to Spindle	19-3/8"
Collet Capacity	1"
Spindle Bore	1-3/8"
Spindle Speeds	12
	50 to 1357 r.p.m.
Power Longitudinal Feeds	70
	.0007" to .0836"
Power Cross Feeds	70
	.0003" to .0303"
Thread Cutting Feeds	70
	4 to 480 per inch

$1574.00 f.o.b. factory

CL1006Z illustrated, less motor, controls, draw-in collet chuck, splash pan, coolant pump. Time terms: 10% down, balance 12 or 18 months.

Can I get it? When? How?

Yes—you can get most any South Bend product immediately from our distributor's stocks in principal cities. Items not stocked, shipped promptly from factory.

Three ways to order:

1. See or telephone nearest distributor.
2. Order by mail from your distributor.
3. If no distributor is nearby, order direct from factory.

South Bend machine tools with accessories may be purchased on convenient terms up to 18 months.

PLEASE SEND INFORMATION CHECKED:

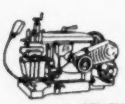
☐ 9" and 10" BENCH LATHES

☐ 10" to 16-24" FLOOR LATHES

☐ DRILL PRESSES

☐ ½" & 1" Collet TURRET LATHES

☐ TOOL GRINDERS



☐ 7" BENCH SHAPERS

Name_____

Street_____ City & State_____

SOUTH BEND

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

For more information on products advertised, use Inquiry Card, page 247

new hob list

CUTTERS · BROACHES · SPECIAL TOOLS

...to help you engineer the gears you need

BRAD FOOTE GEAR WORKS, INC.
CICERO 50, ILLINOIS

56-page Catalog *of tools for making*

WORMS	WORM GEARS
HERRINGBONE	SPUR
STRAIGHT BEVEL	ZEROL
INTERNAL	SPIRAL BEVEL
RACKS	ACME SCREWS
SPROCKETS	SPLINES
KEYWAYS	

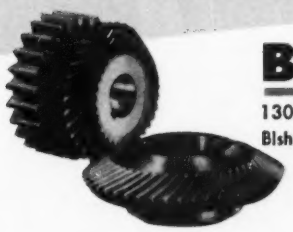
Here's the Way You Can Save Money on Gears

During the many years BRAD FOOTE has been making gears, we have accumulated a large variety of hobs, cutters, and broaches which we have used to make thousands upon thousands of gears to order. With this stock of tools, we are able to do just about any gear cutting job you may have.

By laying out your gears to be made with these tools, you can get what you need quicker . . . and cheaper

Write today on your company letterhead for a free copy of this big catalog which shows all the important specifications needed by gear designers. You'll find it convenient to use, and it will save you money on the gears you buy.

IMPORTANT NOTE: *If you now make your own gears, ask for a copy anyway. You may find that it is cheaper for us to make them.*



BRAD FOOTE GEAR WORKS, INC.

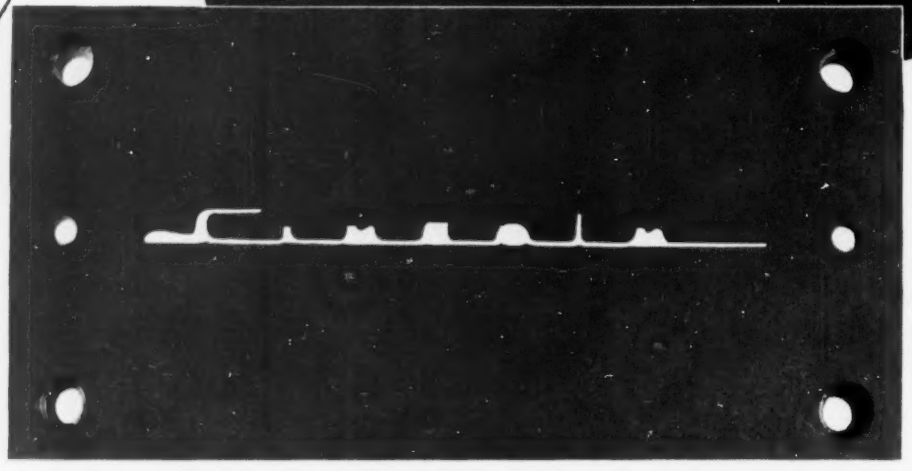
1309 South Cicero Avenue • Cicero 50, Illinois
Bishop 2-1070 • OLympic 2-7700 • TWX: CIC-2856-U

subsidiaries

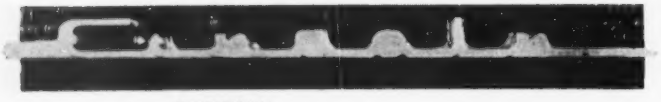
AMERICAN GEAR & MFG. CO. — Phone: Lemont 920 — Lemont, Illinois

PITTSBURGH GEAR COMPANY — Phone: SPaulding 1-4600 — Pittsburgh 25, Pennsylvania

can you make this trim die in eleven hours in your plant?



FINISH TRIM DIE



ELECTRODE

man hours:

ELECTRODE MACHINING..... 8 hours
SETUP..... 2 hours
CUTTING TIME.....1 hour

we will show you how

elox *corporation of michigan*

742 N. Rochester Road • Clawson, Michigan

For more information on products advertised, use Inquiry Card, page 247

GEARS NOISY? ...Of Course

The Gear Business has always seemed to attract colorful and positive characters. Like George B. Grant, the Dean of Gear Makers in the Gay Nineties.

Sixty years ago he gave industry a few gems of philosophy in what he referred to as his Treatise on Gears.

For Instance:

"Noise: at a high speed is unavoidable. Fibre gears are quieter and softer than metal, and raw-hide is still quieter and less durable. Raw-hide and fibre are good at high speed, but unsuitable for heavy strains.

I Am Not Responsible for Any Mistake: even if I make it myself, if it could have been prevented by sending me working drawings or good sketches. If you make me guess, you must take the responsibility. A poor drawing is better than none.

Unless Otherwise Described: every gear ordered is a cut spur gear of cast iron, and it will have such diameter, pitch, face, hole, hub, and quality as I happen to think most desirable. Describe what you want and that you will get, but if you omit any detail I may write to you for the information required or I may guess at it and go ahead.

A Fit: is guaranteed only when I have the parts to be fitted. I ream a hole with a one inch reamer, for example, but do not guarantee that it will fit your one inch shaft.

Estimates: As a rule nothing is saved by getting an estimate. A low price means a cheap piece of work, here or elsewhere.

Steel Castings: are generally full of blow holes, and it takes a long time to get them. A cast iron gear of wider face is as strong and cheaper."

If Mr. Grant could only have run a sound test on RED RING Shaved Gears.

6778

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

READ WHAT **BLOOMER** OF CHICAGO SAYS

ABOUT WALES HOLE PUNCHING UNITS

MONEY AND TIME SAVING FEATURES . . .

Call on Wales-Strippit engineers before putting holes in angles, channels, sheets by any other method.

"NOT ONLY PAID FOR THESE WALES UNITS AND THE PRESS BRAKE BUT ALSO MADE OUR NORMAL PROFIT ON THE JOB"

"SETUPS WITH WALES UNITS ARE 8 TIMES FASTER THAN OUR FORMER GANG PUNCHING METHODS"

"ABLE TO DOUBLE THE RATED PRESS CAPACITY BY STAGGERING SHUT HEIGHT OF WALES UNITS WITH CAPS ON TOP OF PUNCHES"

"ELIMINATE STRIPPING PROBLEMS, SPOILED WORK FROM IMPROPER STRIPPING, AND BROKEN PUNCHES"

BLOOMER HEATING & VENTILATING CO.

Contractors - Fabricators

1247 WEST 37TH STREET, CHICAGO 9, ILL.
FRANKLIN 2-2233

February 26, 1954

Wales-Strippit Corporation
408 Madison Avenue
Oak Park, Illinois

Attention: Mr. Homer C. Gray

Gentlemen:

Very seldom in the operation of a fabricating plant have I come across such cost and time saving opportunities as have been made possible by Wales Hole Punching Units.

To give you a little background, my company bid a job, based on our former gang punching method of tooling, and after we received the order as low bidder, I investigated and bought Wales Units. In addition, we purchased another press brake. The cost records show that we not only paid for these Wales Units and the press brake with this one job but also made our normal profit on the job. We also bettered our delivery estimate by six weeks. Since the completion of this first order I have been using these same Wales Units on similar jobs.

My experiences have proven that setups with Wales Units are eight times faster than our former gang punching methods. Press downtime between setups is practically eliminated by mounting these Units on templates outside the press and just placing the entire assembly on the press bed, ready to start punching.

We were able to double the rated press capacity by staggering the shut height of Wales Units with caps on top of punches. Your Wales Units eliminate stripping problems, spoiled work from improper stripping and broken punches.

I thought you would be interested in these highlights of my experience with your tooling equipment and so I am enthusiastically passing along to you the results of my experiences with Wales Hole Punching Units. I am also enclosing photographs of your equipment in operation.

Very truly yours,

BLOOMER HEATING & VENTILATING COMPANY

E. Ellis

E. Ellis
Plant Superintendent

EE:rp

This letter from Bloomer Heating & Ventilating Company points out typical time saving and money saving advantages that are also experienced by the thousands of users of Wales Hole Punching Units.

Patented, independent, self-contained Wales Units permit the same group of units to be used and reused in unlimited hole punching setups without aligning punches and dies in the press.

Write for the fully-illustrated, functionally colored catalogs that completely describe Wales Hole Punching Units.

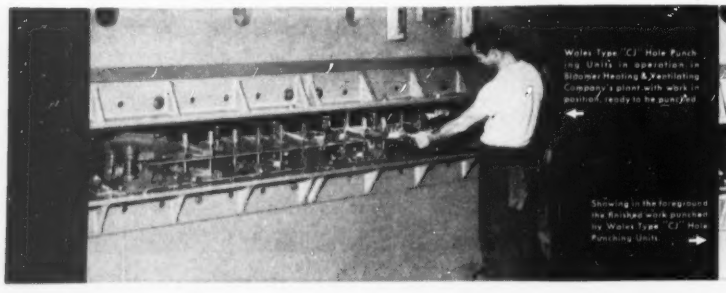
WALES-STRIPPIT CORPORATION

George F. Wales, Chairman

375 Payne Avenue, North Tonawanda, N. Y.
(Between Buffalo and Niagara Falls)

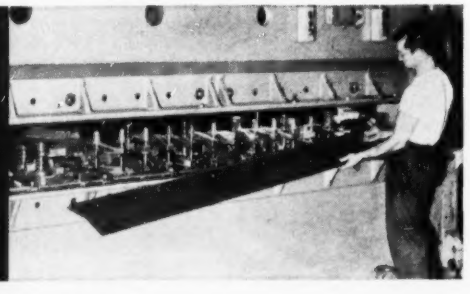
Wales-Strippit of Canada Ltd., Hamilton, Ontario

Specialists in Punching and Notching Equipment



Wales Type "CJ" Hole Punching Units in operation in Bloomer Heating & Ventilating Company's plant with work in position ready to be punched.

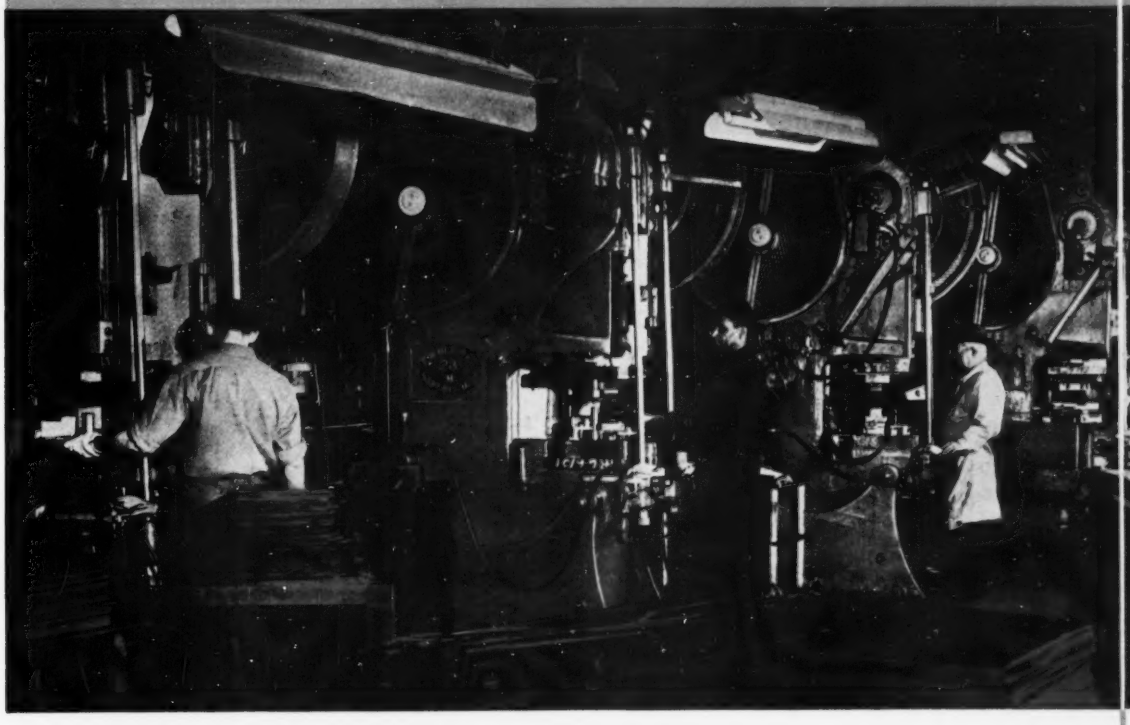
Showing in the foreground the finished work punched by Wales Type "CJ" Hole Punching Units.



For more information on products advertised, use Inquiry Card, page 247

At Art Steel Company, too,

BLISS Presses Predominate



97% are Bliss-Built

Now, Art Steel Company, one of the leading manufacturers of steel office equipment — *Steelmaster* — credits Bliss with an important role in its progress. For Art Steel has looked to Bliss since 1923 for engineering counsel and the right press for each operation. Seventy-three Bliss presses making up 97% of Art Steel's press equipment attest to the fact that Bliss has justified this confidence.

Asked *why the continued preference for Bliss presses,* Art Steel officials sum it up in one word — "*dependability*".

And that's why hundreds of sheet metal plants throughout this country and abroad specify Bliss presses more than any others. Whether your requirements involve mechanical or hydraulic presses . . . high speed or normal speed . . . straight side or gap frame . . . it pays to call for a Bliss engineer. He can show you why Bliss belongs in *your* press room, too.

E. W. BLISS COMPANY, CANTON, OHIO

E. W. Bliss (England) Ltd., Derby, England

E. W. Bliss Company (Paris), St. Ouen sur Seine, France

U. S. Plants in Canton, Salem and Toledo, Ohio; and Hastings, Michigan. Branch offices in Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, Toledo; and Toronto, Canada. West Coast Representatives: Moore Machinery Co., Los Angles and San Francisco; Star Machinery Company, Seattle. Other representatives throughout the world.

• • •

BLISS on your press is more than a name ...it's a guarantee!

STANWAY INDUSTRIAL OILS

How a little talk
(with the right person)
stopped a lot of chattering

● Chattering and scoring of ways was causing trouble for the Elkin Tool and Manufacturing Company of Detroit. The trouble was noted on a big planer operating under extremely heavy loads.

Here's how a little talk with the right person helped clean up the trouble. A Standard Oil lubrication specialist was consulted and he recommended the use of STANWAY No. 95, a good stable oil having extreme oiliness and containing a tackiness agent. Result: smooth operation, complete elimination of chattering and scoring.

STANWAY Industrial Oils were developed to meet the extreme oiliness requirements of certain machine tools customarily operating under very heavy loads. They are also recommended for other severe operating conditions where sliding friction poses a lubricating problem. STANWAY Industrial Oils are part of a complete line of industrial oils, cutting oils and coolants that serve all industry.

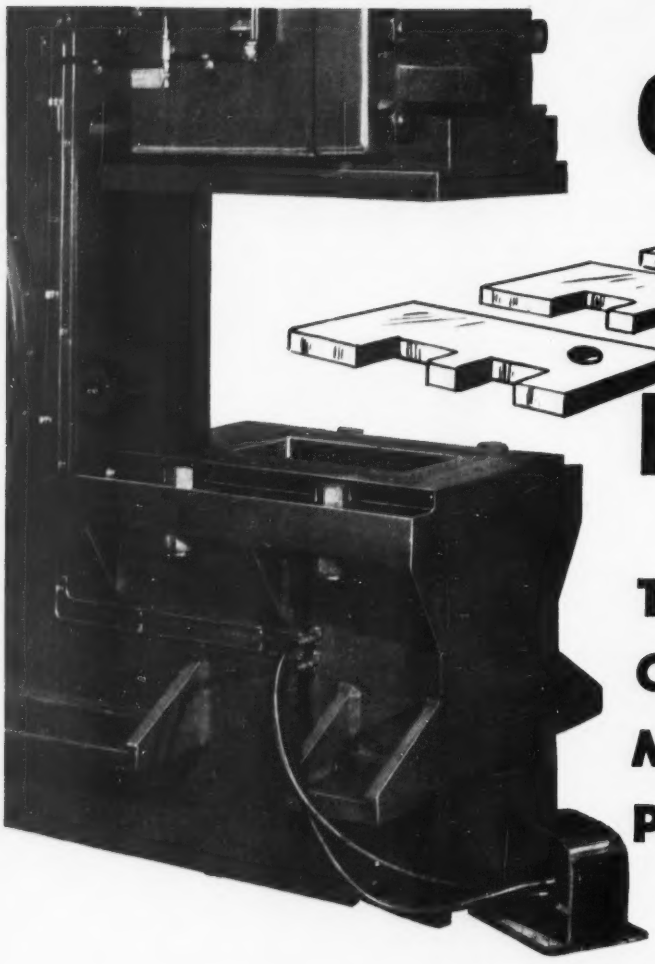
No matter how special your problem may be, there's a Standard Oil product to solve it. There's also a near-at-hand Standard Oil lubrication specialist to help you select and apply the right one. To obtain his services call the Standard Oil office nearest you, or write: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

The right person in this case was E. F. Aschemeyer, typical member of the corps of lubrication specialists located in Standard Oil offices throughout the Midwest. Aschemeyer put his practical experience and special training to work to help the Elkin Company solve *their* problem successfully. You too, can get this kind of expert help on your lubrication problems when you call Standard.

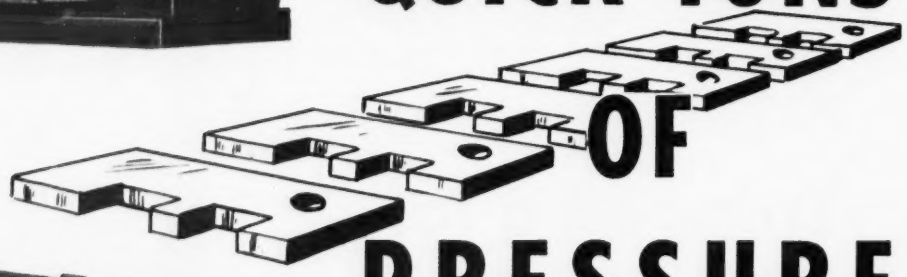
STANDARD

STANDARD OIL COMPANY

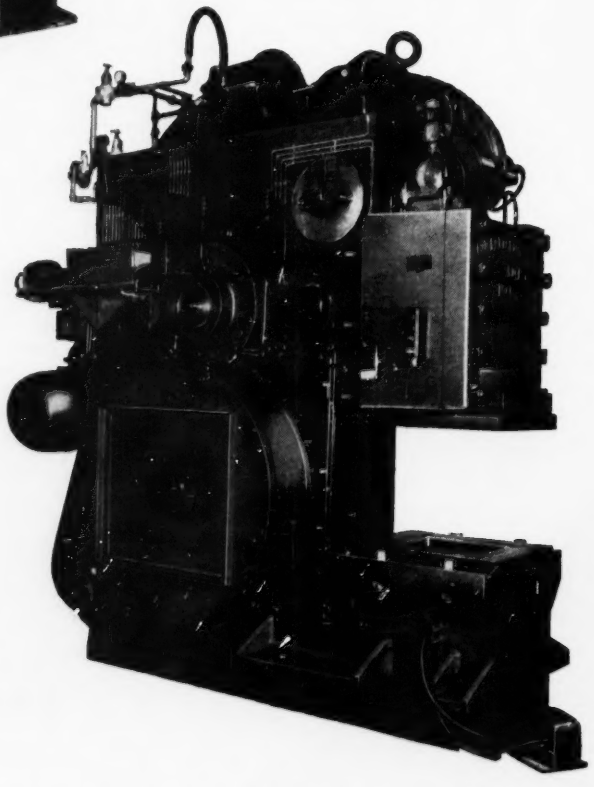
(Indiana)



QUICK TONS OF PRESSURE



TO PUNCH, SHEAR OR BLANK AS MANY AS 35 PIECES PER MINUTE!



"Buffalo" MILL TYPE SHEAR

- Available in 250 to 1200-ton capacities
- High-production speeds—up to 35 strokes per minute!
- Longer power strokes—up to 6"!

TOOLING SPACE OPEN ON 3 SIDES!

- Precision built with rigid electrically welded steel plate frame

Put your heavy jobs on this pay-off production basis—

WRITE TODAY FOR BULLETIN 3650!

BUFFALO FORGE COMPANY

440 Broadway Buffalo, N.Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING SHEARING BENDING

For more information on products advertised, use Inquiry Card, page 247

Mr. and Master Mechanics

This is Dad's special day . . . Family Open House at Lodge & Shipley . . . time when he can show off to his youngster. Perhaps making lathes doesn't seem as thrilling now to the boy as being a baseball star, but Son's impressed with the "wonderful" lathes . . . and Dad's beaming.

The youngster is like the thousands of Lodge & Shipley lathe users who for decades have been impressed by the results of craftsmanship like his Dad's. They translate the boy's words of wonder into more specific terms like "time savings and cost cutting." They see in the intricate Lodge & Shipley headstock, with its 599 precision parts, workmanship that won't make headlines . . . but will help in the struggle against ever-rising costs.

Why not let us send you a file of case histories and other information on more profitable production with Lodge & Shipley Lathes.

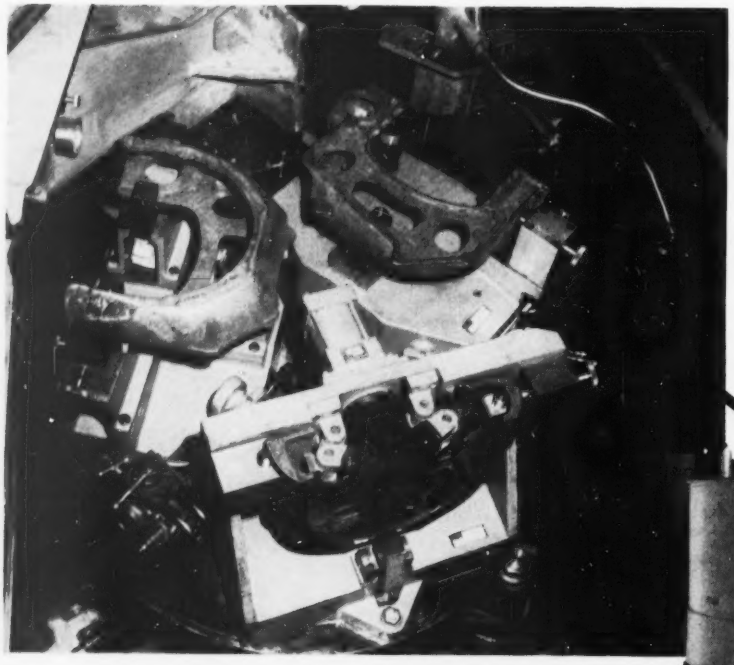
Just write The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

Lodge & Shipley

. . . . your **LODGE**-*ical choice!*

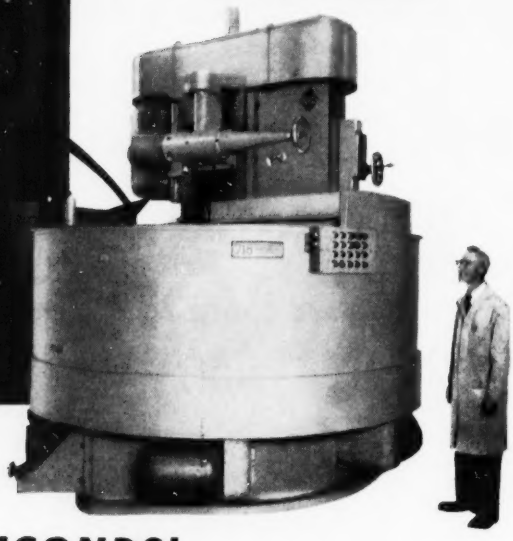
MULTI-STATION FIXTURING GIVES

Continuous Low Cost Production



on this *New*

BESLY-BOWEN GRINDER



One Fly Wheel Housing
—Ground on Three Surfaces

—*EVERY 72 SECONDS!*

That's the production achievement of this Model 718 Besly-Bowen Radial Head Face Grinder, used to grind automotive fly wheel housings. Accuracy is also noteworthy. With approximately 3/32-in. of stock removed from each face, work is held parallel within .003, flat within .005 and to size within .010.

Multi-station grinding is one important reason for this performance. Two stations, each consisting of a 40-in. diameter rotary table holding three pneumatic clamping fixtures, are used with this grinder. At each of the fixtures, a different face of the fly wheel housing is presented to the grinding disc; this results in a completely ground housing with each cycle of the grinder. While grinding automatically proceeds at one station, the operator is free to unload, clean and reload housings at a second rotary table. Grinding is continuous at alternate stations with no time lost for loading and unloading. The fly wheel housings are ground accurately and quickly without distortion because of the controlled progressive grinding cycle.

Where high volume and precision in a sequence of grinding operations is your problem, it will pay to investigate the Besly-Bowen line. Write for a full description.

The 718 Besly-Bowen — a new kind of surface grinder with these features:

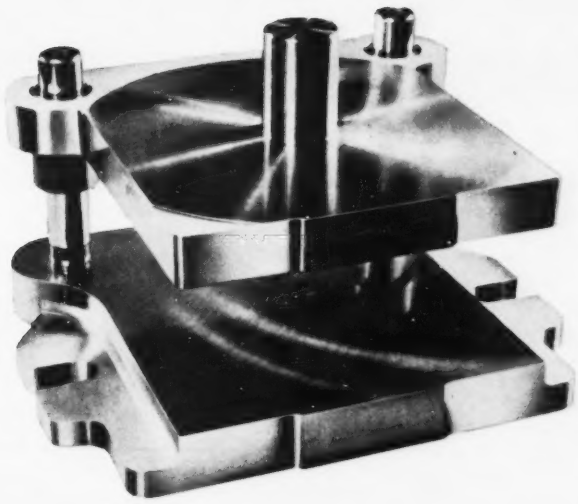
- Multi-station Fixturing Permits Continuous Grinding of Sequence Operations—No Interference Between Loading and Grinding
- Automatic Grinding Cycle
- Automatic Size Control
- Fixturing Flexibility
- Single, Massive Slow-Moving Bearing Insures Accuracy with Four-Way Compound Movement . . . Up — Down — Back and Forth
- A Wet Grinding System—Free from Flying Water and Spray

Write for a Full Description of This Type of Grinder
Available in four models from 5-100 H.P.

BESLY-WELLES
CORPORATION
Established as CHARLES H. BESLY and COMPANY in 1875
112 Dearborn Avenue, Beloit, Wisconsin

BESLY GRINDERS and ACCESSORIES
● BESLY TAPS, DRILLS, REAMERS, END MILLS
BESLY-TITAN ABRASIVE WHEELS

For more information on products advertised, use Inquiry Card, page 247



DANLY'S IN THE PICTURE

at Eastman Kodak Company

Danly Die Sets play an important role in the manufacture of Eastman's popular new Brownie movie camera and Brownie movie projectors . . . latest in the Eastman line that Danly Die Sets have helped build all through the years. Used to mount high precision dies, Danly Die Sets help bring "master die" accuracy to every finished part. But Danly Die Sets do more . . . even before a press run ever starts. They make tooling-up easier, faster—save you many, many hours in the die shop. And once in production, these same Danly Die Sets do their share to maintain non-stop production . . . save down-time . . . increase die life. And remember, Danly Die Set service is as quick and convenient as a phone call.

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue, Chicago 50, Illinois

DANLY

DIE SETS . . . STANDARD OR SPECIAL
DIEMAKERS' SUPPLIES

PICK THE DANLY BRANCH NEAREST YOU!

***CHICAGO** 50	2100 S. Laramie Avenue
***CLEVELAND** 14	1550 East 33rd Street
***DAYTON** 7	3196 Delphos Avenue
***DETROIT** 16	1549 Temple Avenue
***GRAND RAPIDS**	113 Michigan Street, N.W.
INDIANAPOLIS 4	5 West 10th Street
***LONG ISLAND CITY**	47-28 37th Street
***LOS ANGELES** 54	Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2	111 E. Wisconsin Avenue
***PHILADELPHIA** 40	511 W. Courtland Street
***ROCHESTER** 6	33 Rutter Street

**Indicates complete stock.*

Product Directory

To find headings easily, look for capital letters at top of each page to denote locations.

ABRASIVE CLOTH, Paper and Belt
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVES
See Discs, Abrasive

ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.

To Make SURE That YOUR CLUTCH Application Is RIGHT

Before you approve the blueprint for your next model — double check to make sure it includes the latest improvements you can build into your product with the right type and size ROCKFORD CLUTCH. It will pay you to consult our engineers concerning technical clutch advances that will give you and your customers the advantages of better power transmission control.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER-TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

ROCKFORD CLUTCH DIVISION BORG-WARNER
▲ 410 Catherine Street, Rockford, Illinois, U.S.A. ▲

ROCKFORD CLUTCHES

Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc,.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York 1, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEELS, High Temperature
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

ALLOYS, Non-Ferrous
American Brass Co., 25 Broadway, New York.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ALLOYS, Zinc
New Jersey Zinc Co., 160 Front St., New York, N. Y.

ARBOR PRESSES
See Presses, Arbor

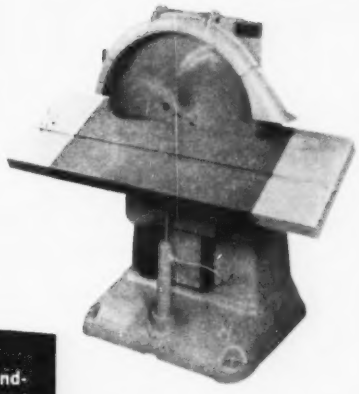
ARBORS AND MANDRELS
Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Beaver Tool & Engineering Corp. (Arbors, only), 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Keo Cutters, 19326 Woodward, Detroit, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.

(*Continued on page* 312)

For more information on products advertised, use Inquiry Card, page 247

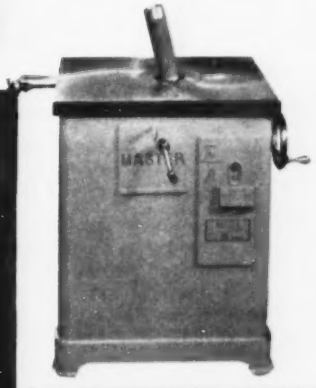
MASTER Profile grinders for Contour Grinding of Metal

MASTER 24" and 30" Disc Grinders and Sanders for Wood, Metal and Plastics



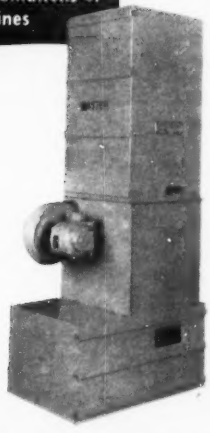
QUALITY PRODUCTS

that Increase Production, Precision and Profits



MASTER Spindle Sanders for Contour Sanding of Wood, Metal and Plastics

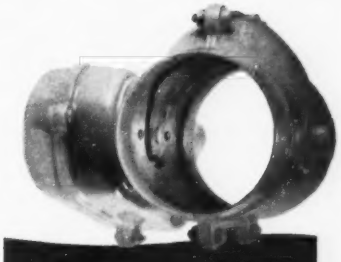
MASTER Dust Collecting Units for Individual Machines or Combinations of Machines



The Kindt-Collins Company has over 40 years experience in the industrial field. We have pioneered in the design and manufacture of many different types of machinery and equipment, that have received wide acceptance for their ability to increase shop production, precision and profits. Write for illustrated booklet showing the complete Kindt-Collins line of machinery.

• ***DEALER INQUIRIES INVITED!*** •

KINDT-COLLINS MASTER PRODUCTS



MASTER Ventomatic Air Control Valve for increasing efficiency of dust collectors.

THE KINDT-COLLINS COMPANY

12653 ELMWOOD AVENUE • CLEVELAND 11, OHIO

Manufacturers of Pattern Shop Supplies • Industrial Supplies • Machinery • Equipment • Dust Collectors • Dowels • Wax Products • Fillets

New Big Barrel Micrometers have 7 Big Features

1 **Easy-to-Reach Ratchet Cap. A Lufkin Exclusive! With the ratchet right in the cap you can still take "one-hand" measurements. Ratchet is completely enclosed protecting it from dirt and grit.**

2 Big, Sensitive Direct-Feel Thimble.

3 Perfect Balance in Shorter Length.

4 Non-Glare Satin-Chrome Finish — easier reading in either bright or poor light.

5 **Easy-to-Read Markings Widely Spaced on Big Barrels. Circumference of the new barrel has been increased nearly 20%— wider spacings between graduations make it easier to estimate tenths of thousandths.**

6 Rapid Reading — Big Numbers Mark Every Thousandth. Graduation lines are longer and clearer.

7 **Slip-proof Black Crackle Finish on Frame. A Lufkin Exclusive. This durable and attractive finish makes the micrometer easiest to handle, especially when hands are oily.**

Designed by LUFKIN for Faster, Easier, more Accurate Measurements

This new micrometer is designed to make it the best balanced, easiest and most accurate to use. Lufkin micrometers are the easiest to adjust, too — the reading line always keeps its original position directly in line of vision, and the thimble doesn't cover measurements on the hub. Hardened and ground one piece spindle. Micro-lapped anvil and spindle faces. Tapered frame for use in restricted space. Available with carbide-tipped anvil and spindle faces.

306 **BUY LUFKIN TAPES - RULES - PRECISION TOOLS FROM YOUR DISTRIBUTOR**

THE LUFKIN RULE COMPANY, SAGINAW, MICHIGAN

132-138 Lafayette Street, New York City • Barrie, Ontario

Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Western Tool & Mfg. Co., 1640 E. Wheeler St., Springfield, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

BABBITT

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Keller Tool Co., Grand Haven, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.

BALLS

Kennametal, Inc., Latrobe, Pa.

BARS, Phosphor Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BARS, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., (Cold Drawn), Republic Bldg., Cleveland, Ohio.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Sttel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded

Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

BEARINGS, Babbitt

Bunting Brass & Bronze Co., Spencer and Carlton Ave., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Ball

Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Torrington Co., Torrington, Conn.

(*Continued on page* 314)

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Automatic Turret Lathes

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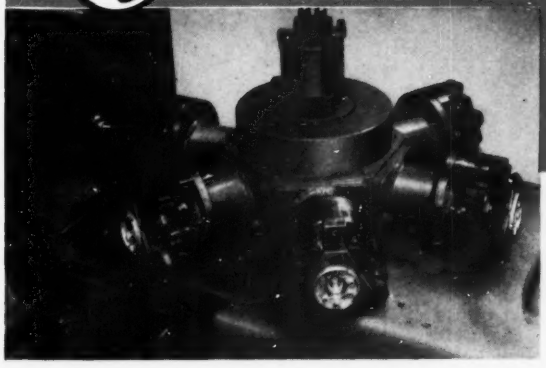
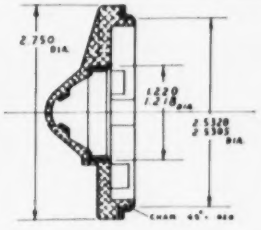
P&J TOOLING

American Bosch manufactures small electric motors used in seat adjuster mechanism for Lincoln-Mercury and other passenger cars. The aluminum housings required are machined at 170 pieces per hour.





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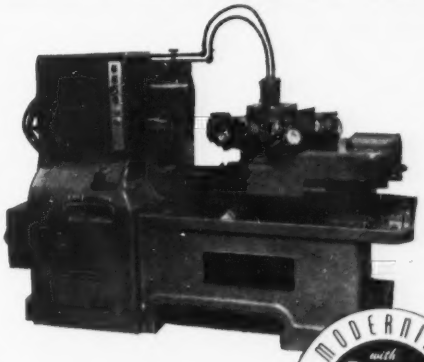
Machine loading time was eliminated, costs lowered, and production greatly increased by the use of air operated chucks on each of the six turret faces. The operator simply inserts the work piece in the open jaws, a stationary air-cylinder (operated by the dog-drum) automatically controlling chuck opening and ejection, and chuck closing. Turret indexing is automatic, rapid and accurate. Idle cutting time is reduced to a minimum . . . the fast, rapid-traverse mechanism moving the turret slide quickly to within 1/64" of feeding position.

You too can benefit from this combination. At no obligation, send today for your copy of the 3-U Bulletin No. 145 . . . or ask our Tool Engineers to submit recommendations based on your own prints or sample parts.



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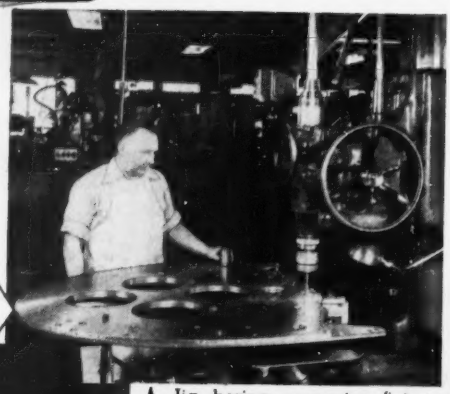
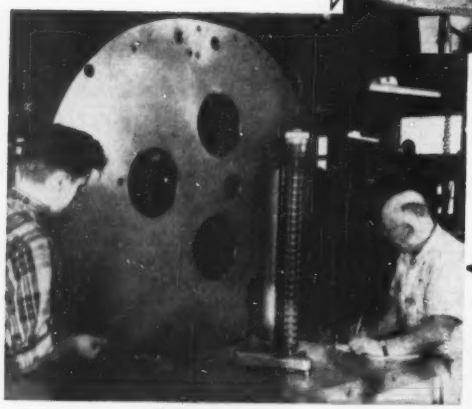


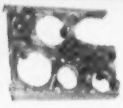
Single jig boring projects such as this jet aircraft fixture.

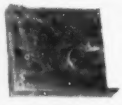


Jig boring a master fixture section for jet aircraft. Bushings were fitted to multiple holes with tolerances accurate to .0005".

Final inspection of one of four fixture sections for jet aircraft. This master fixture measures 18 feet when fully assembled.

Production jig boring projects such as thousands of these precision components.





Or this seemingly impossible assignment: To bore over 148 different size holes at different angles, holding rigid relative tolerances into precision alloy castings, completed value of which, was over $5000 each.

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Johnson Bronze Co., New Castle, Pa.
Link Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Lineshaft
Fafnir Bearing Co., New Britain, Conn.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, Needle
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Orange Roller Bearing Co., Inc., Orange, N. J.
Torrington Co., Torrington, Conn.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., Harrison, N. J.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

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Johnson Bronze Co., New Castle, Pa.

BEARINGS, Tapered Roller
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
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Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
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Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

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Standard Pressed Steel Co., Jenkintown, Pa.

BELTING, TRANSMISSION
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
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(*Continued on page 320*)

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Tooth form; tooth parts (20 to 200 D.P.); formulas for dedendums and root diameters of fine-pitch gears that are hobbed, shaped or pre-shaved; dimensions required when using enlarged fine-pitch pinions for standard center-distance system or enlarged center-distance systems; classification according to quality; and tolerances for 20-degree involute fine-pitch gear blanks.

Backlash in Gears

Recommended backlash with tables for American Standard spur, helical, herring-bone and bevel gears, American Standard 20-degree involute fine-pitch gears, Gleason system straight, zerol and spiral beval gears, and Gleason hypoid gears.

Dedendums and Root Diameters for Hobbing, Shaping and Pre-Shaving Spur Gears

Formulas and tabulated data for a wide range of pitches covering recommended dedendums and root diameters of hobbed, shaped and pre-shaved 14½- and 20-degree involute full depth, 20-degree involute fine pitch, and 20-degree involute stub teeth.

Gleason System Bevel Gears

Formulas, tabulated data, and design charts for Gleason straight and spiral bevel gears for all types of industrial applications. Design of bevel gear blanks, mountings for bevel gears, thrust and radial loads produced by bevel gears. Durability and strength of bevel gears. Worked out examples of bevel gear design.

American Standard Fine-pitch Bevel Gears

Formulas and tabulated data for dimensions of fine-pitch straight and angular straight bevel gears.

American Standard Milling Cutters

Definitions of milling cutter terms; number of teeth for optimum performance; dimensions and tolerances of standard types of milling cutters; and set-ups for grinding clearance angles on milling cutter teeth.

American Standard Single-point Tools and Tool Posts

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Honing

Amount and rate of stock removal, formula for rotative speeds, recommended tolerances, and possible adjustments for eliminating undesirable conditions.

Power Brush Finishing

Characteristics and applications of brushing wheels, brushing speeds, and adjustments for eliminating undesirable conditions.

Materials

Nickel and nickel alloys, titanium and titanium alloys, copper-silicon and beryllium copper alloys, and revised list of chemical elements, atomic weights and melting points.

Tool and Die Steels

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Standard Washers

Nominal and limiting dimensions of plain washers, spring lock-washers, and internal-tooth, external-tooth, and countersunk external tooth lock washers.

Standard Straight Pipe Threads

Sizes, threads per inch and limiting dimensions of straight pipe threads for free-fitting mechanical joints for lock-nut connections; Dryseal internal threads (used without sealer); and internal threads in pipe couplings (used with sealer).

Standard Dryseal Taper Pipe Threads

Dimensions for crest and root modification of standard taper pipe threads for provision of metal-to-metal self-sealing joint.

American Standard Screw-Thread Gages

Thread form, tolerances and wear allowances for the GO, HI and LO thread gages, also formulas for limiting dimensions of thread gages and setting plugs for use with Unified and American Standard screw threads.

American Standard Square and Hexagon Bolts and Nuts

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American Standard Stub Acme Screw Threads

Thread form, allowances, tolerances, limiting dimensions and preferred thread series of the revised Stub Acme threads.

Feeds and Speeds for Gear Hobbing

Climb hobbing; use of single- and multiple-thread hobs; and feeds and speeds for roughing with single- or multiple-thread hobs and finish hobbing of various types of gears.

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Description, designations, ranges of standard sizes, boundary dimensions and tolerances for standard types of ball, roller, and needle bearings.

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Splines
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Chain Transmissions
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Knurls
Broaches
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Testing the Hardness of Metals
Iron and Steel Castings
Heat Treatment Processes for Steel
Sub Zero Treatment of Steel
Heat Treatment of Non-ferrous Alloys
Brass and Bronze Alloys
Cast and Wrought Aluminum Alloys
Cast and Wrought Magnesium Alloys
Nickel and Nickel Alloys
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Copper-Silicon and Beryllium Copper Alloys

Metal Cutting
Cam Milling
Tapping and Thread Cutting
Thread Milling
Thread Grinding
Thread Rolling
Helical Milling
Broaching
Knurling
Screw Machine Feeds and Speeds
Grinding
Honing
Speeds and Feeds for Various Metal Cutting Operations
Tool Grinding
Cutting Fluids
Machining Magnesium and Aluminum
Machining Plastics
Machining Nickel Alloys
Abrasive Cutting
Milling Machine Indexing
Gear Cutting

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Extrusion of Metals
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Precision Investment Casting
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Forge Shop Welding Methods
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Welding with Thermit
Electric Welding
Soldering, Brazing and Hard-Facing
Powdered Metal Process
Patterns
Punches, Dies and Presswork
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Honing Process
Laps and Lapping
Power Brush Finishing
Polishing and Buffing
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Chromium Plating
Coloring Metals

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Nails and Spikes
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Screw Thread Systems
Plain and Lock Washers
Pipe Thread System

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Shackles
Lifting Magnets
Wire Rope

Measurement and Inspection
Checking Gear Sizes
Measuring Screw Theads
Measuring Instruments and Gaging Methods
Weights and Measures
Metric System of Measurement and Conversion Tables
Weights of Various Metal Shapes and Parts

Allowances and Tolerances
Allowances and Tolerances for Plain Fits
Tolerances for Sheets, Plates, Bars and Tubes
Tolerances for Forgings
Allowances and Tolerances for Screw Threads
Tolerances for Thread Gages
Tolerances for Various Machining Operations
Tolerances for Fine-pitch Gear Blanks
Backlash Tolerances for Gears

Electric Motors
Standards
Characteristics
Applications
Maintenance

Other Subjects
Dimensioning and Checking Drawings
Wire and Sheet Metal Gages
Jigs and Fixtures
Bearing Lubricants
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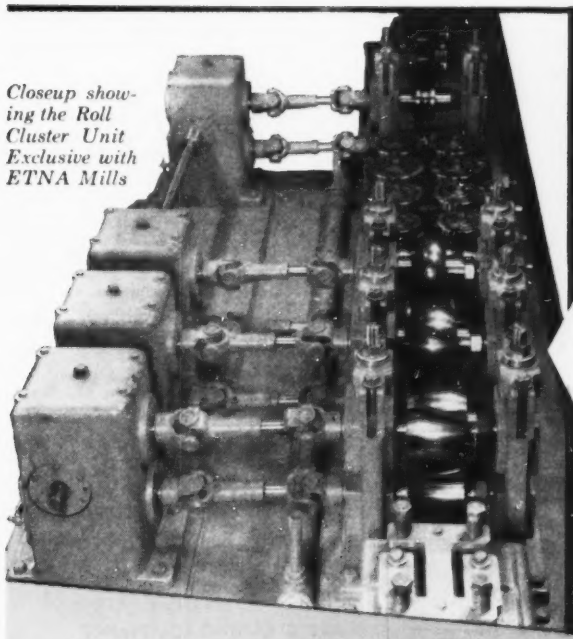

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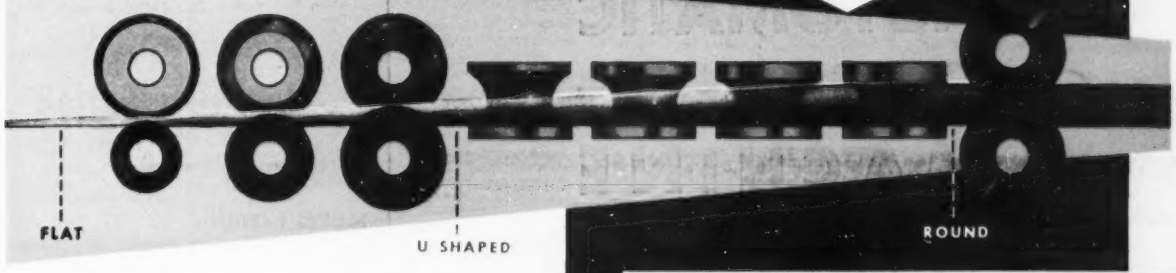
FOR SMOOTH, WELL FORMED STEEL TUBING



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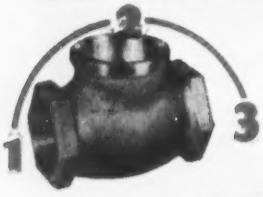

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Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
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Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
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New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

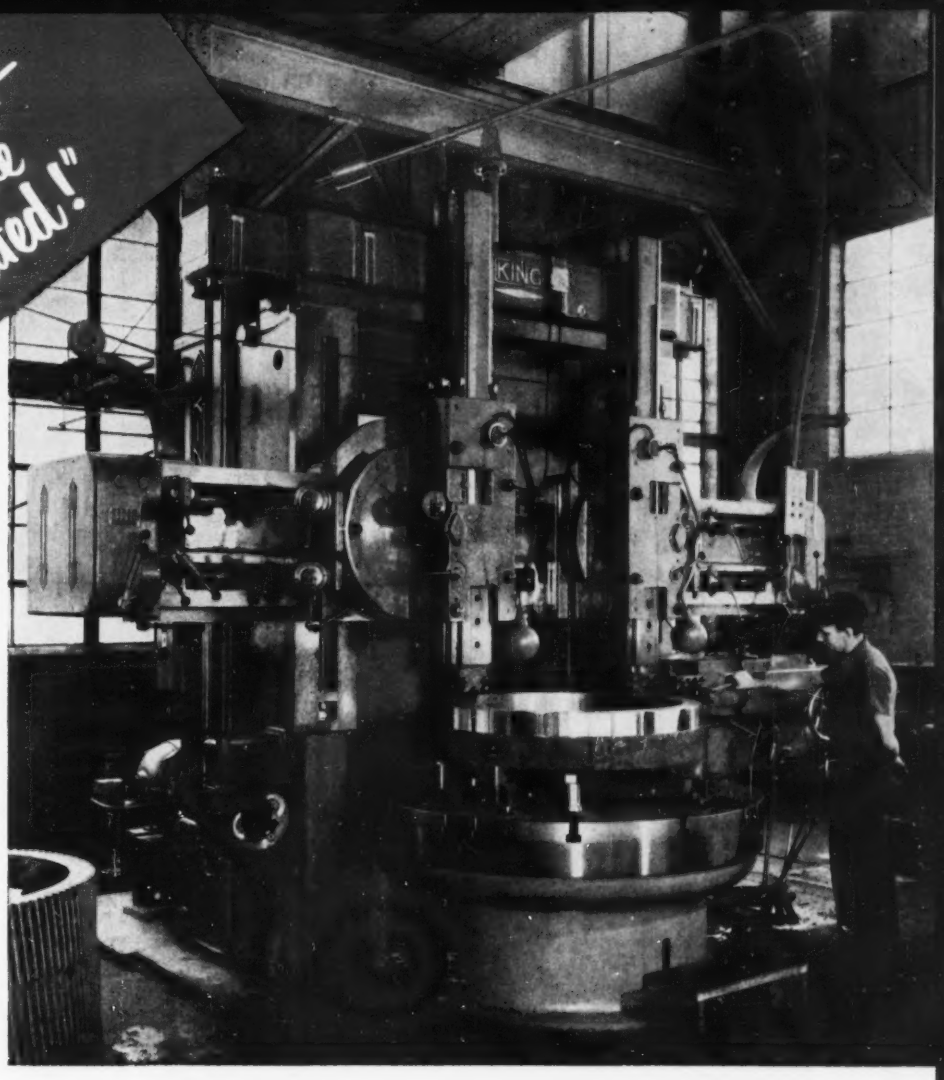
BOLTS AND NUTS
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only)
Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

BOLTS, T-Slot
O. K. Tool Co., Milford, N. H.

(*Continued on page 322*)

For more information on products advertised, use Inquiry Card, page 247

"It's the most solid, smoothest-running machine I've ever operated!"



Says Veteran of Many Years on the Boring Mills at

THE TOOL STEEL GEAR & PINION CO. *(Cincinnati)*

The 72" boring mill pictured here is one of the many rugged, versatile KINGs with unmatched performance records at "Tool Steel." This particular KING is shown machining the inner diameter of a 50" O.D. ring gear—one of a wide range of jobs handled. At the controls is operator Arthur "Babe" Wilson. From long and diversified boring mill experience, Mr. Wilson knows the KING is really "king" in operating efficiency—and in the above quoted statement, he enthusiastically says so.

Massive proportions and extra-heavy construction give all KING machines the *rigidity* essential for fast, heavy work with consistent precision accuracy. Also, a wider feed and speed range plus simplified control make the KING adaptable for all types of boring, turning, and facing work—light or heavy, large or small.

KING machines are available in ten sizes, from 30" to 144", and in a variety of head combinations, with or without side head. For complete details, contact your local KING distributor—or write us direct.

Supreme
in Power, Speed, Accuracy . . .
SOLID RIGIDITY
KING
VERTICAL BORING & TURNING MACHINES

American Steel Foundries

KING MACHINE TOOL DIVISION

1150 TENNESSEE AVENUE CINCINNATI 29, OHIO

These SPECIAL FORMED WHEEL DRESSERS and a watch have one thing in common.

Both are designed and made by specialists. Vinco will design and build special dressers which will dress wheels to grind involute, serration and straight sided splines, as well as helical and spur gears. These same dressers can be set up to grind the tooth flank, fillet and root in one operation. Dressers can be designed for dressing special forms consisting of angles, radii, a series of either or combinations of both. When formed wheel dressers are needed, your best bet is Vinco.

Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.

Metal Component Parts Mass Produced • Aircraft and Commercial Gears • Model B-1 Dresser • Precisiondex • Spline Gages Master Gears • Gear Rolling Inspection Fixtures • Camshaft Comparators • Optical Master Inspection Dividing Heads • Involute Checker. ®

VINCO

MILLIONTHS OF AN INCH FOR SALE

TRADEMARK OF DEPENDABILITY

BOOKS, Technical

Industrial Press, 148 Lafayette St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

BORING AND DRILLING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Canedy-Otto Div. Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Wales-Strippit Corp., N. Tonawanda, N. Y.

BORING AND TURNING MILLS, Vertical

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING BARS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Homestrand Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING, DRILLING AND MILLING MACHINES, Horizontal

(Floor, Planer or Table Types)

Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.

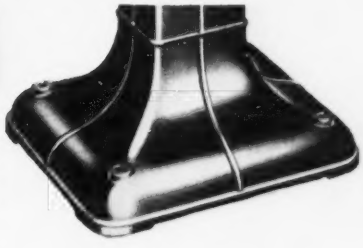
(*Continued on page* 324)

For more information on products advertised, use Inquiry Card, page 247

"Our DELTA Saved 20 Times Original Cost... WORTH ITS WEIGHT IN DIAMONDS"

"The savings effected with this 6" DELTA Grinder amount to over $2,000.00 over a nine-year period," reports Mr. Grey, shop foreman at Precision Gear and Machine Company.

Both bench and floor models of the DELTA Carbide Tool Grinder operate *without vibration* because they have dynamically balanced aluminum wheel mountings that are machined *after* assembly. Tilting table (30° toward and 45° away from the wheel) is supported by wide-spread, double trunions.



Precision Gear and Machine Company, Charlotte, N. C., placed a Rockwell-built DELTA Carbide Tool Grinder in their plant nine years ago. Employed to grind carbide cutting tools for eighteen lathes in the machine shop, the DELTA Grinder is equipped with one 6", 120 grit silicon carbide wheel, and 6" diamond wheel with ⅛" side face.

Comments Boyce Grey, shop foreman: "In the nine years since we bought it, our DELTA 6" Grinder has saved us over $2,000.00. The ruggedness and accuracy of the DELTA lets us do the same quality work with 6" diamond wheels that we used to do with far more expensive 10" wheels. This means that the saving in diamond wheels alone has been over twenty times the original cost of the grinder. I guess you could say it's worth its weight in diamonds."

DELTA Carbide Tool Grinders and other rugged, low-cost DELTA Power Tools will perform 90% of the jobs in your shop to the same accuracy standards as special machines costing many times as much.

That's why — throughout industry — there is a growing trend toward accurate, portable, low-cost DELTA Power Tools. You can use them to cut costs, too. Talk to your DELTA Dealer; he's listed in the classified section of your phone book under "TOOLS" or "MACHINERY." Send the coupon for complete data.

Delta Power Tool Div.,
Rockwell Manufacturing Co.
614E North Lexington Avenue,
Pittsburgh 8, Pa.

☐ Please send Delta AB-53 catalog.
☐ Please send name of my nearest Delta Dealer.

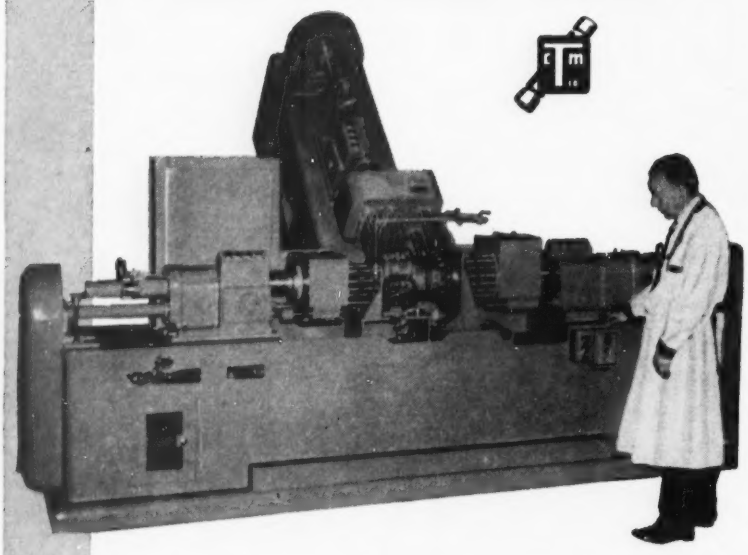
Name.....
Company.....Title.....
Address.....
City.....Zone.....State.....

DELTA QUALITY POWER TOOLS
Another Product by **Rockwell**

DELTA QUALITY MAKES THE DIFFERENCE

For more information on products advertised, use Inquiry Card, page 247

Another Cleveland Design to Speed Production!



3-WAY HORIZONTAL TAPPING MACHINE

OPERATION: Tapping 48 holes in crankcase. Tapping time (48 holes) 7.9 seconds.

DESCRIPTION: A Cleveland Three Way Horizontal Tapping Machine with two F-2 Cleveland Tapping Heads opposed at each side and one F-2 head at 45° up at the rear with multiple heads on each head to suit the part. The right hand tapping head has a multiple head with 18 spindles; the left hand tapping head has a multiple head with 12 spindles; the rear vertical unit has a multiple head with 20 spindles.

The operator loads part into position between the tap guard plates and then moves the lever to the closed position and starts the machine. All heads tap simultaneously.

Send for your copy of this Guide

Write today for Catalog No. MY-54

CLEVELAND tapping machine co.

A Subsidiary of AUTOMATIC STEEL PRODUCTS, INC. • CANTON 6, OHIO

Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Mummert-Dixon Co., Hanover, Pa.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Bryant Chucking Grinder Co., Springfield, Vt.
Chandler Tool Co., 514 Ohio Ave., Muncie, Ind.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Simplex Machine Tool Corp., 4528 W. Mitchell St., Milwaukee, Wis.

BORING MACHINES, Jig

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Wales-Strippit Corp., N. Tonawanda, N. Y.

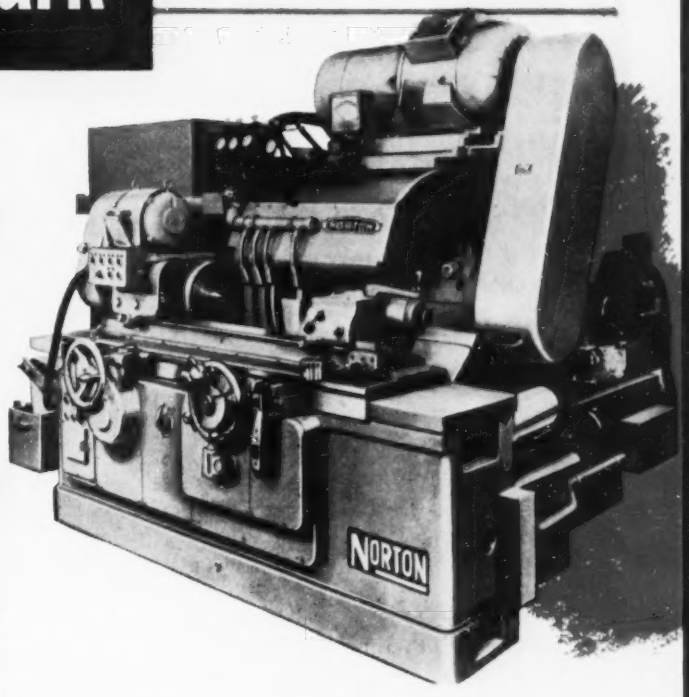
BORING TOOLS

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Atrax Co., Newington, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal Inc., Latrobe, Pa.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.

(*Continued on page* 326)

Another first

...For Delpark Filtration



NORTON'S GRINDER Features *Built-in* Delpark Filtration

Recognition by Norton engineers of DELPARK as the finest in coolant filtration is acknowledged by the incorporating of DELPARK Filtration *into* the design of a new grinding machine introduced by Norton.

This machine is the Norton Type CM-1 Heavy Duty Semiautomatic Multi-Wheel Grinder. This unit utilizes several grinding wheels mounted between bearings for simultaneously grinding different diameters on the work piece in a single plunge-grind operation. Heavy sludge loads produced are immediately removed eliminating time loss necessary to clean reservoirs. Coolant supply is constantly kept clean and free of particles which would spoil the finish of ground work.

Thank you Norton, for your recognition of DELPARK Filtration as the finest.

Write for the Delpark brochure on Norton's new type grinder

Norton Type CM-1 Heavy Duty Semiautomatic Multi-Wheel Grinder with built-in Delpark Filtration

Delpark INDUSTRIAL FILTRATION

BACKED BY MORE THAN 30 YEARS EXPERIENCE IN INDUSTRIAL FILTRATION

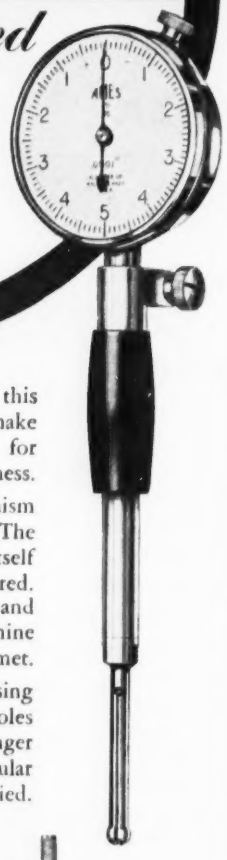
INDUSTRIAL FILTRATION COMPANY, 15 INDUSTRIAL AVENUE, LEBANON, INDIANA

AMES

... the Preferred

FOR FAST, ACCURATE INSPECTIONS

Small Hole Gauge No. 36



Skilled and unskilled employees can use this superbly designed two-point contact gauge to make quick, accurate, *impersonal* inspections of small holes for size, taper and roundness.

The Ames No. 36 has extremely sensitive mechanism especially designed to eliminate "feel" in measuring. The spherical contact point automatically centers itself and indicates the true diameter at the point measured. The operator has only to slide the contact in and around the hole and note the readings to determine if tolerances are being met.

The Ames Small Hole Gauge No. 36, using contacts in increments of 1/32", can check holes of 3/16" to 1" diameter, up to 2" depth. Longer lengths and special contacts to check irregular recesses, splines, etc., can be supplied.

Ames No. 15 Jaw Gauge

Ames No. 13 Dial Comparator

Ames No. 516 Dial Micrometer

Ames No. 25 Pocket Thickness Measure

If you would like to have our recommendations on your measurement problem, send blueprints and specifications. Write for your free copy of catalog on Ames precision measuring instruments.

Representatives in principal cities. B. C. AMES CO. *27 Ames Street Waltham 54, Mass.*

Mfgr. of Micrometer Dial Gauges • Micrometer Dial Indicators

Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bliss E. W., Co., 1375 Raff Road, S. W., Canton, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINES

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Zagar Tool Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md., (Portable Elec.).
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Thor Power Tool Co., Aurora, Ill.

BULLDOZERS

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Atrax Co., Newington, Conn.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

(*Continued on page 328*)

For more information on products advertised, use Inquiry Card, page 247

Close Tolerance

High Strength

YOU CAN HAVE ALL SIX ... PLUS *Uniform Machinability*

Fine Surface

Maybe you want some of these properties in your steel parts. Or a combination of them. Or only one.

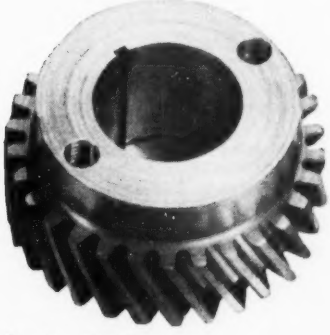
No matter which ones you need, you get them—plus *uniform machinability*—in Republic Cold Drawn Steels.

That's why so many manufacturers have come to Republic with their machining problems. Manufacturers whose costs and production records show their automatics aren't turning out what they could.

Republic's 3-D Metallurgical Service focuses the combined experience of the Field, Mill and Laboratory on your particular problem. And the recommendation you get is based on your plant, your product, and your equipment.

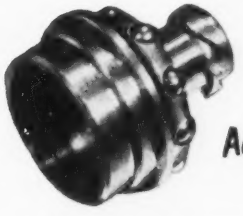
There's no reason to deny yourself this service. It costs only the price of a phone call to your nearest Republic office. And it can save you a lot. Do it today.

Toughness



Hardenability

REPUBLIC STEEL CORPORATION
Alloy Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N.Y.



Accuracy of Section

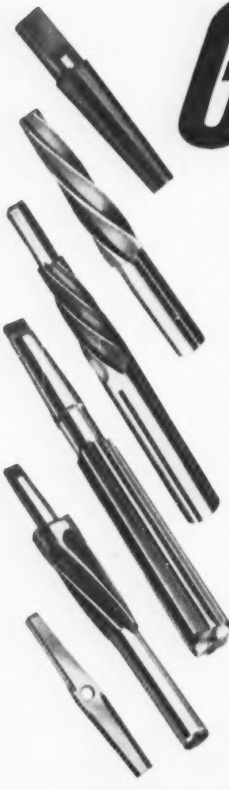
REPUBLIC COLD DRAWN ALLOY STEEL BARS

REPUBLIC STEEL

Other Republic Products include Carbon and Stainless Steels—Sheets, Strip, Bars, Wire, Pig Iron, Steel and Plastic Pipe, Bolts and Nuts, Tubing

FOR SPECIAL REAMERS . . . REMEMBER

GORHAM



They may not *look* alike, but all of the special tools on this page share a common function . . . *because every one is a reamer!* Each was engineered and manufactured by Gorham Tool Company to provide a practical solution to a specific production machining problem for one of our customers.

Actually, these reamers represent just a few of the many special-purpose cutting tools produced by Gorham. Others include milling cutters and end mills, inserted blade cutters, flat and circular form tools, profile cutters, and carbide tipped tools of every description. Gorham "specials" are turning problems into profits in thousands of plants every day . . . and the one we engineer for you will solve *your* next production machining problem, too! Take advantage of our experience.

Your nearby Gorham Field Engineer is a qualified cutting tool expert in both practical design and actual application, and his assistance is yours without obligation. Just write for his name, or send details of your problem direct to us. We'll have him get in touch with you promptly.

Gorham TOOL COMPANY

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

14405 WOODROW WILSON • DETROIT 3, MICHIGAN

WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

Chambersburg Engrg. Co., Chambersburg, Pa.
Lake Erie Engineering Corp., Kenmore Station Buffalo, N. Y.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

BURS

See Files and Burs, Rotary

BUSHINGS, Brass, Bronze, Carbide, Etc.

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Johnson Bronze Co., New Castle, Pa.
Kennametal, Inc., Latrobe, Pa.

BUSHINGS, Hardened

Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

BUSHINGS, Jig

Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

CALIPERS

Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C., & Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

CAM CUTTING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CAM MILLING AND GRINDING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Waynesboro, Pa.
Orban Kurt Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rowbottom Machine Co., Waterbury, Conn.

CAMS

Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN

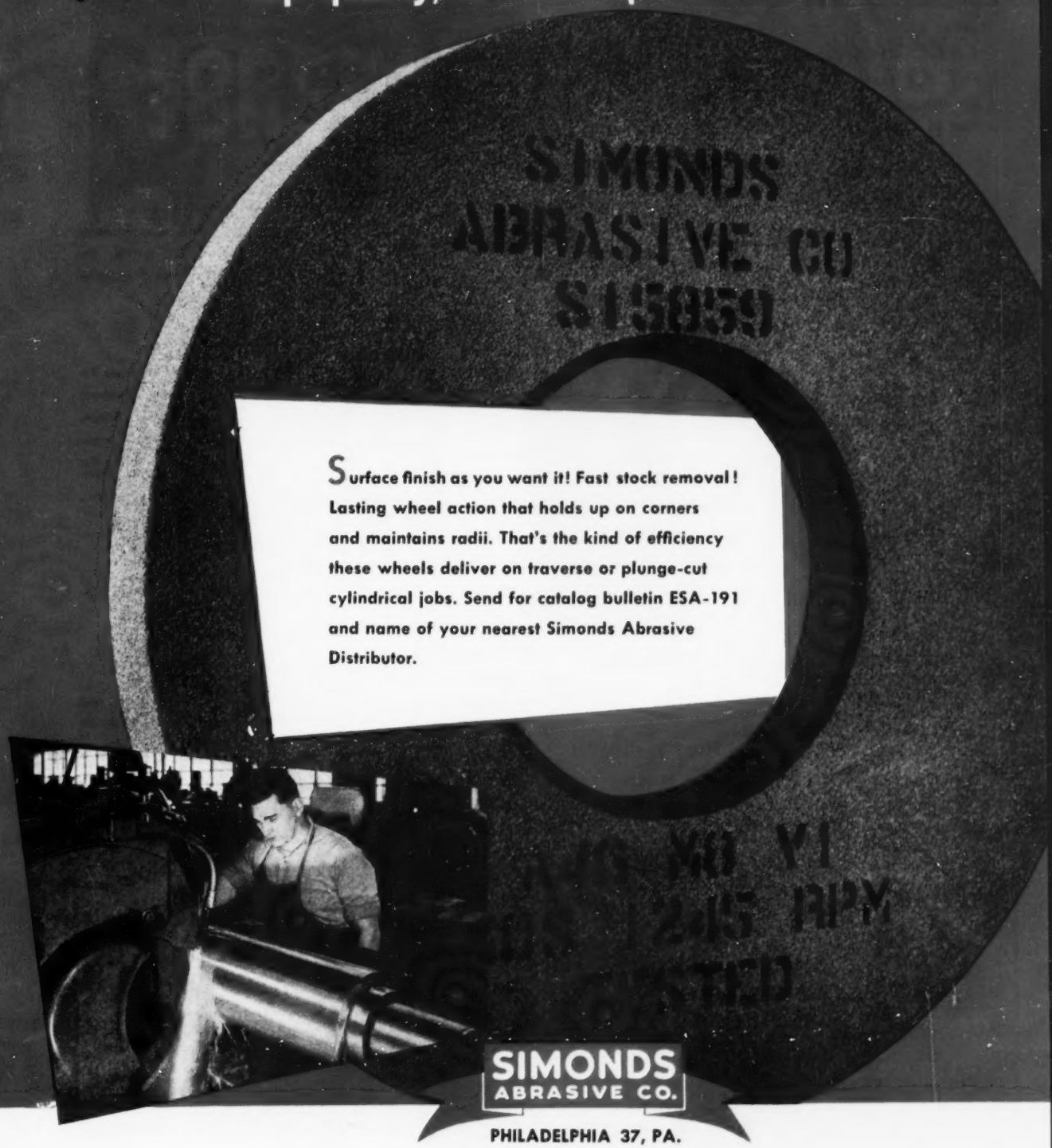
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

(*Continued on page* 330)

For more information on products advertised, use Inquiry Card, page 247

any way you look at it...

SIMONDS grinding wheels for CYLINDRICAL GRINDING give top quality, low cost production



Surface finish as you want it! Fast stock removal! Lasting wheel action that holds up on corners and maintains radii. That's the kind of efficiency these wheels deliver on traverse or plunge-cut cylindrical jobs. Send for catalog bulletin ESA-191 and name of your nearest Simonds Abrasive Distributor.

SIMONDS ABRASIVE CO.

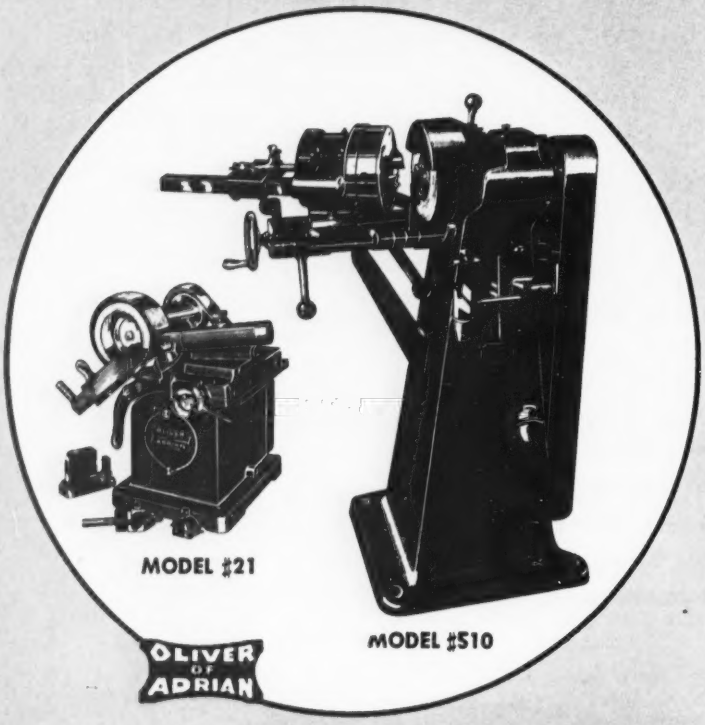
PHILADELPHIA 37, PA.

BRANCH WAREHOUSES: BOSTON, DETROIT, CHICAGO, PORTLAND, SAN FRANCISCO • DISTRIBUTORS IN PRINCIPAL CITIES

DIVISION OF SIMONDS SAW AND STEEL CO., FITCHBURG, MASS. • OTHER SIMONDS COMPANIES: SIMONDS STEEL MILLS, LOCKPORT, N.Y., SIMONDS CANADA SAW CO., LTD., MONTREAL, QUEBEC AND SIMONDS CANADA ABRASIVE CO., LTD., ARVIDA, QUEBEC

OLIVER DRILL POINTERS
Are BEST for *Your* Toolroom

Because... **they give you the only scientifically correct *and* theoretically perfect drill point. Twist drills machine-ground with OLIVER DRILL POINTERS assure uniformity—last from two to three times longer than hand-ground drills.**



Save time and money the Oliver Way:

Improperly ground drills ultimately increase costs—cause rejects and production lags.

Make your drills last longer, cut faster and more accurately . . . at the first sign of dullness or inaccuracy, remove them from the drilling machine — machine-grind them with OLIVER DRILL POINTERS.

No. 510 for drills ¼" to 3"—2-3-4 flute. Variable clearances. Variable point angles. Automatic operation.
No. 21 Oliver Bench Grinder. Hand operated for Drills No. 57 to ½". Right hand, with an improved point. Attachments are available for grinding oil hole drills, left hand and other special points.

Write for our free Booklet
"How To Produce More Holes With Your Drills!"
See our catalog in Sweet's Directory

OLIVER INSTRUMENT CO.
1410 E. MAUMEE • ADRIAN, MICHIGAN

MACHINE TOOLS by OLIVER include:
AUTOMATIC DRILL GRINDERS
TOOL & CUTTER GRINDERS
DRILL POINT THINNERS
TEMPLATE TOOL GRINDERS
FACE MILL GRINDERS
DIE MAKING MACHINES

CASEHARDENING FURNACES
See Furnaces, Heat-Treating

CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

CASTINGS, Die
American Brass Co., Waterbury 20, Conn.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, IRON
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.

CASTINGS, Steel, Alloys, Etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Lebanon Steel Foundry, Dept. J, Lebanon, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTERING MACHINES
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Dertoit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CENTERS, Lathe
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Union Twist Drill Co. Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(Continued on page 332)

For more information on products advertised, use Inquiry Card, page 247

SPLIT DIE FORGING

FOR AMERICAN INDUSTRY

BETTER PRODUCTS

LARGE SIZES*

INTRICATE SHAPES

AT REDUCED MANUFACTURING COSTS

*Large sizes and intricate shapes can now be forged up to 5,000 pounds.

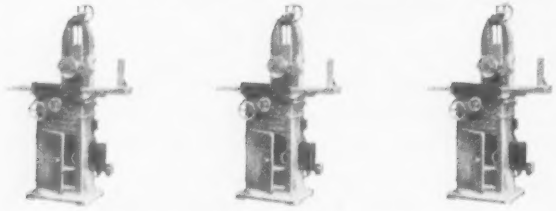
FORGE AND ORDNANCE DIVISION

Cameron

IRON WORKS, INC.
HOUSTON, TEXAS

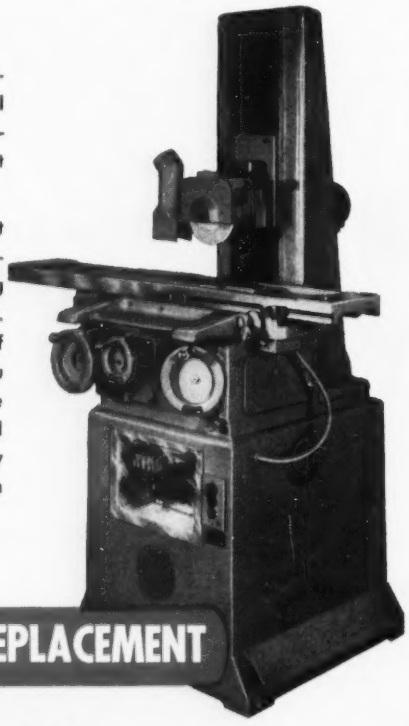
Write for illustrated brochure.

ANTIQUE SURFACE GRINDERS will keep you in the RED



Operating over-age surface grinders in your toolroom — the focal point of all quality production — deals a punishing blow to plant costs and efficiency.

Recent surveys show that one out of every five machines now in operation is incapable of meeting today's precision tooling demands. If your plant is still using one of these antiques, it's time for you to talk with your Reid dealer. He will show you how modern Reid Grinders will increase accuracy and efficiency in your toolroom production.



PLAN NOW FOR REPLACEMENT

with REID GRINDERS

For complete information on Reid Surface Grinders, write today for Catalog 618-2.

see our catalog in MACHINE TOOL CATALOGS or write for copy

Model 618V illustrated

Reid Brothers Precision Surface Grinders Company, Inc.

BEVERLY, MASSACHUSETTS

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St New York, N. Y.
Thor Power Tool Co., Aurora, Ill.

CHUCKING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co., (Single and Multiple Spindle) 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Air Operated

Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Whiton Machine Co., 190 Howard St., New London, Conn.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Collet or Split

See Collets

CHUCKS, Diaphragm

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

CHUCKS, Drill

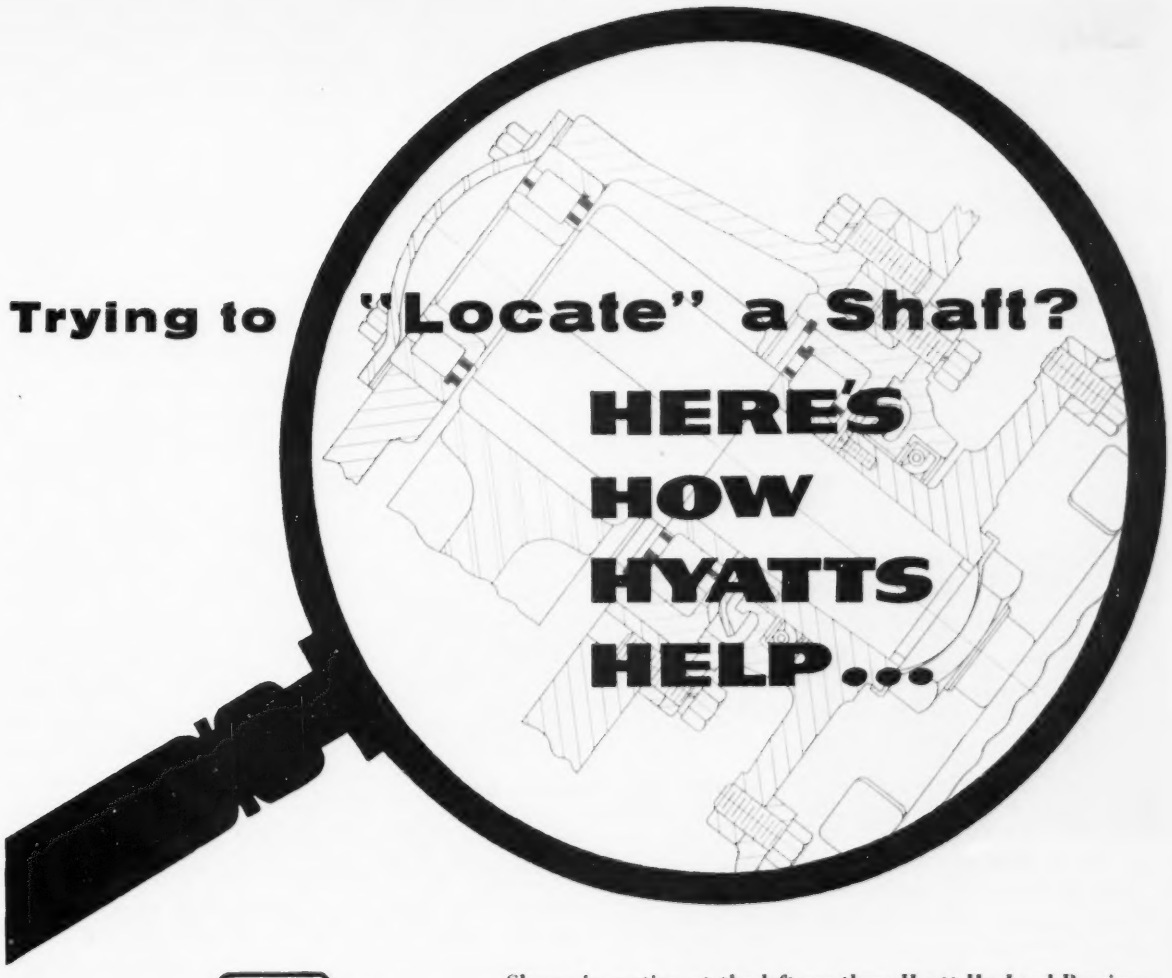
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Supreme Products, Inc., 2222 So. Columet, Chicago 16, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHUCKS, Full Floating

Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

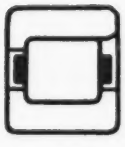
(*Continued on page* 334)

Trying to "Locate" a Shaft?

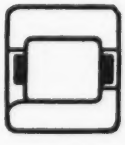


HERE'S HOW HYATTS HELP...

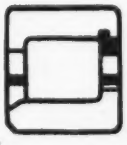
3 TYPES



BUL separable outer race series



RWB separable inner race series



RYS separable inner race series

Shown in section at the left are three Hyatt Hy-Load Bearing types that are used for axial shaft location. Flanges on inner or outer races limit axial shaft movement and permit the bearing to take light, intermittent thrust loads.

Since Hyatt inner races are assembled on shafts, with relatively heavy press fits, no accessory parts are necessary to hold them in place.

Hyatt Hy-Load Bearings are available with a variety of combinations of race flanges, snap rings, cages or separators, so that just the right combination can be selected for each set of operating conditions.

Hy-Loads are available in three diameter series, two widths and a complete range of sizes. For complete information write for Catalog 150—Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS

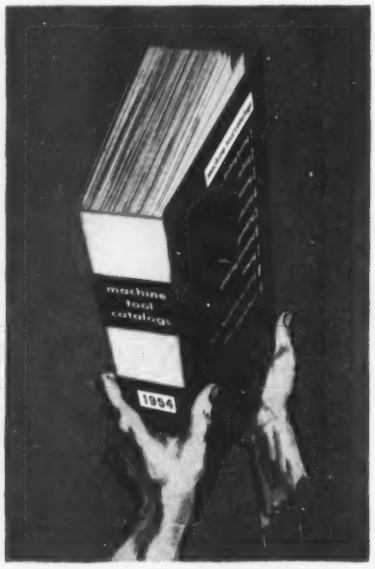
STRAIGHT BARREL TAPER

For more information on products advertised, use Inquiry Card, page 247

need information on

turning machines?

reach for Machine Tool Catalogs



"... a great time-saver"

These manufacturers' catalogs are instantly available in Section 3 of your Machine Tool Catalogs:

Bullard Co.	Nebel Machine Tool Co.
Cincinnati Lathe & Tool Co.	New Britain Machine Co. Gridley Machine Div.
Cleveland Automatic Machine Company	Rivett Lathe & Grinder, Inc.
Cone Automatic Machine Co.	Seneca Falls Machine Co.
Gisholt Machine Co.	Sheldon Machine Co., Inc.
Greenlee Bros. & Co.	Sidney Machine Tool Co.
Jones & Lamson Machine Co.	Troglia Fratelli, Sas
R. K. LeBlond Machine Tool Co.	Turchan Follower Machine Co.
Monarch Machine Tool Co.	Wade Tool Co.
	Warner & Swasey Co.

ALSO: **The following catalogs, in other sections of your Machine Tool Catalogs, contain information on turning machinery:**

Armstrong Bros. Tool Co.	Landis Tool Co.
Besly-Wells Corp.	Motch & Merryweather Machinery Co.
Boyar-Schultz Corp.	Norton Co.
Brown & Sharpe Mfg. Co.	Ohio Machine Tool Co.
Bryant Chucking Grinder Co.	Sheffield Corp.
Consolidated Machine Tool Corp.	Sunstrand Machine Tool Co.
Dake Engine Co.	Taft-Peirce Mfg. Co.
Davis & Thompson Co.	Thomas Machine Mfg. Co.
Hall Planetary Co.	Wales-Strippit Corp.

In other sections of the File you will find additional catalogs containing useful information on a wide range of machine tools and accessories.

Sweet's Catalog Service

Division of
F. W. Dodge Corporation
119 West 40th Street,
New York 18, N. Y.

CHUCKS, Gear

Gleason Works, 1000 University Ave., Rochester, N. Y.
Horton Chuck, Windsor Locks, Conn.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.

CHUCKS, Lathes, Etc.

Buck Tool Co., 220 Schippers La., Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Whiton Machine Co., 190 Howard St., New London, Conn.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety

Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jarvis, Charles L., Co., Middletown, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Gardner Mch. Co., Div. Landis Tool Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CIRCUIT-BREAKERS

General Electric Co., Schenectady 5, N. Y.

CLAMPING APPLIANCES FOR MACHINE TOOLS

Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Swartz Tool Products Co., Inc., 13330 Foley Ave., Detroit, Mich.

CLAMPS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Starrett, The L. S., Co., Athol, Mass.
Swartz Tool Products Co., Inc., 13330 Foley Ave., Detroit, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CLEANERS, Chemical, for Metal

Bullard Co. Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York N. Y.

CLUTCHES

Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Formsprag Co., 23609 Hoover Rd., Van Dyke, Mich.
Link-Belt Co., 300 West Pershing Rd., Chicago 9, Ill.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

COLLARS, Safety

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

COMPARATORS

See Gages, Comparator.

COMPARATORS, Optical

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning

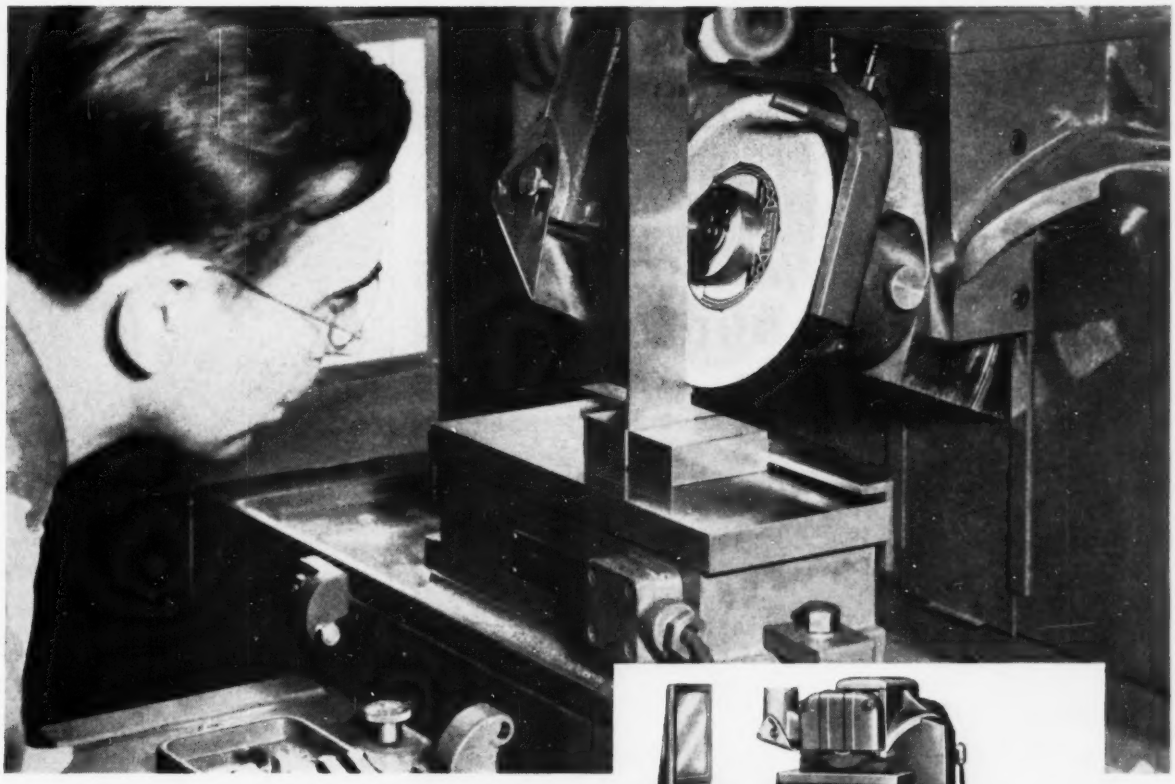
Houghton E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York.

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lapping).
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Shear-Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

(*Continued on page* 336)

For more information on products advertised, use Inquiry Card, page 247



GRIND TO .0001" OR LESS

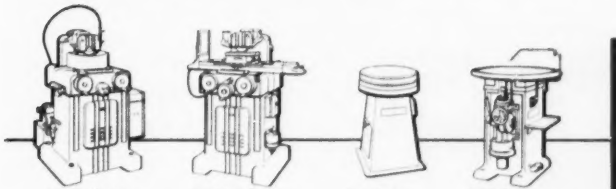
. . . and do it easily with a Taft-Peirce No. 1 Surface Grinder

This Taft-Peirce No. 1 Surface Grinder produces surfaces of an accuracy, flatness, and finish formerly considered difficult or impossible to achieve. An experienced operator frequently can grind to .00005" . . . with surfaces so smooth, in many cases, they seal without lapping.

Table, saddle, and column travel on ball bearings retained in vees of hardened and ground alloy steel. As a result, there is practically no wear on ways and moving parts. Grinding time is sharply reduced.

Control of feeds is smooth and precise. You can repeat wheel positioning true to dial setting without fear of gouging the work. Vernier fine-feed attachments are available, for either the horizontal or vertical feed, for direct readings of .0001".

Another feature — a tilting wheelhead, as shown above, simplifies setups, speeds difficult angle and shoulder work. Compact, yet heavier than other machines, the No. 1 Grinder maintains its accuracy over many years of rugged service. For more details on this and other Taft-Peirce items, write for handbook.

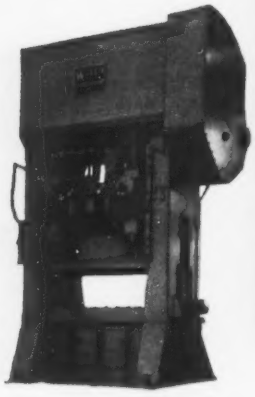


T-P means Top Precision

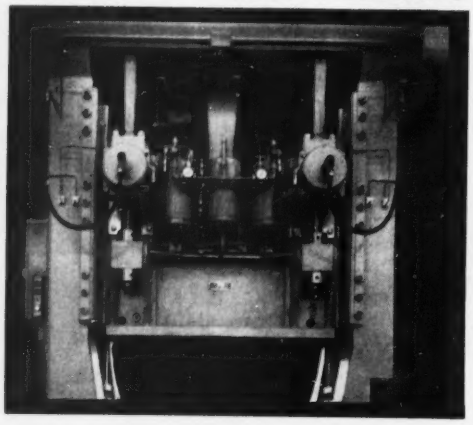
THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

NEW Warco®

HYDRO-PNEUMATIC DEVICE ELIMINATES DOUBLE-ACTION BLANKHOLDING PROBLEMS



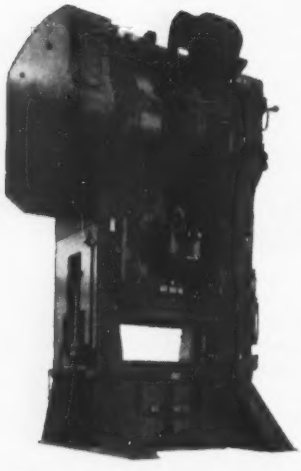
Front view of Warco Press with device installed.



Double-Action Press Operators—Here's a simple and compact hydro-pneumatic force adjustment device that acts as safety overload protection for the blankholder and provides a means for adjusting the blankholder pressure independently at all four corners.

This new unit makes it possible to determine the blankholder pressure required at each corner, and to duplicate this setting whenever the job is re-run, without having to repeat the tedious setting required with the rigid blankholder. It also provides a positive safety overload protection in case of double blanks, as the device will detect the double blank and stop the press before damage to the press and dies occur.

This Warco Hydro-Pneumatic Blankholder, of size and capacity required, can be incorporated as an extra feature in Warco Double-Action Presses. For further information, estimates, etc., contact Warco Press Division, Federal Machine and Welder Co., Warren, Ohio.



Rear view of Warco Press with device installed.

Federal® WELDERS

Warco® PRESSES

THE FEDERAL MACHINE AND WELDER COMPANY

WARREN, OHIO

COMPOUNDS, Resin and Molding
General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Fellows Gear Shaper Co., Springfield, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Minster Machine Co., Minster, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

CONTROLLERS
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.
Clark Controller Co., Cleveland, Ohio.
General Electric Co., Schenectady 5, N. Y.

CONTROLS, THERMO
Control Products, Inc., 306 Sussex St., Harrison, N. J.

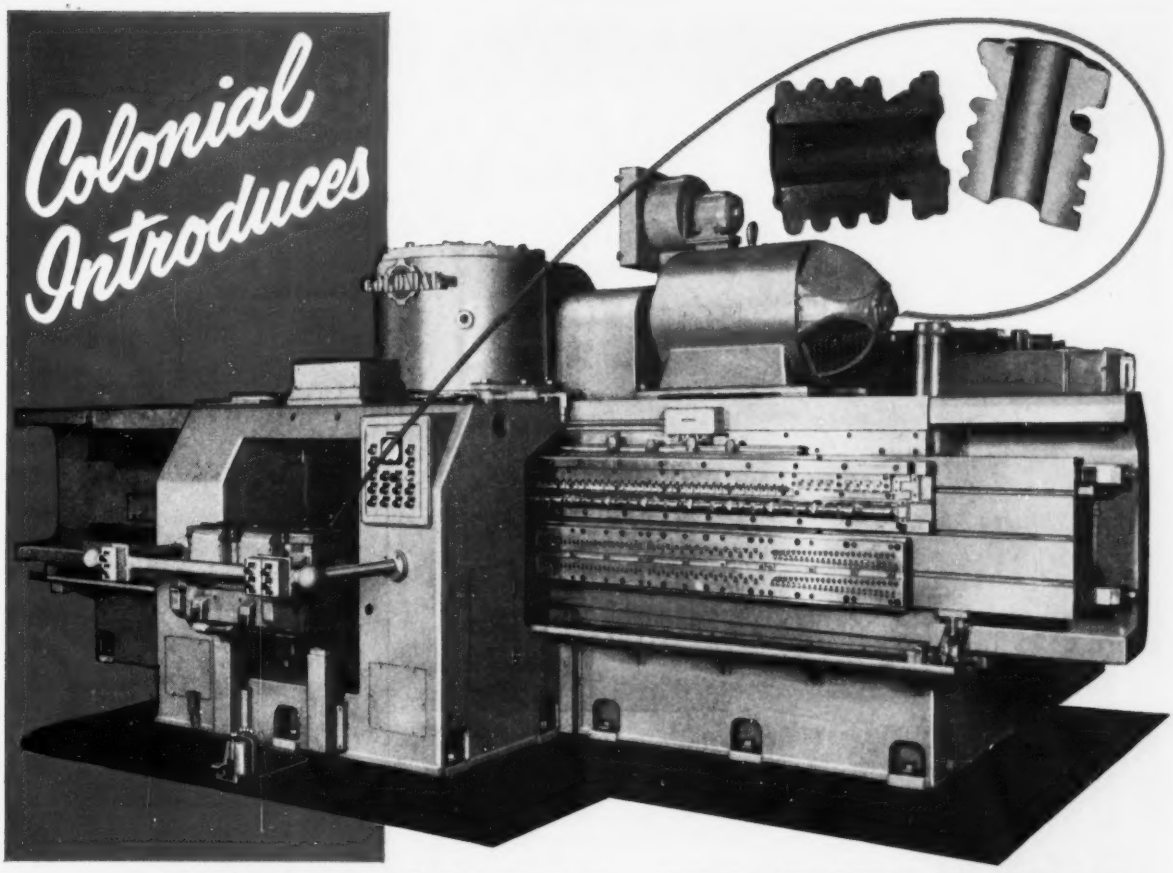
CONVEYORS FOR DUST, CHIPS, ETC.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9.

COOLANT SEPARATORS
See Separators, Oil or Coolant.

COUNTERBORES
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Besly-Welles Corp., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wison, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

(*Continued on page* 338)

Colonial Introduces



the MECHANICAL HORIZONTAL

for faster broaching of surfaces

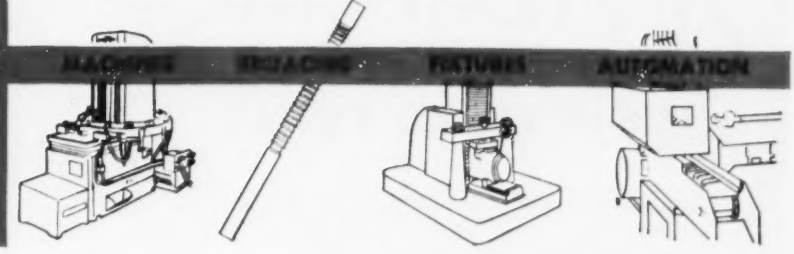
The model HM-25-130, is the first in a new line of Colonial MECHANICAL HORIZONTALS. It removes 3½ pounds of metal, with depth of cut varying from 5/32 to 3/16 of an inch, in a 21-second broaching cycle from two cast iron bearing cap clusters. Tungsten carbide-tipped tool bits mounted on the 24" wide ram, travel at more than 140 feet per minute. The machine broaches on both the forward and return strokes, doubling the length of cutting action as compared to ordinary broaching. The machine has a 130-inch stroke and 25-ton capacity. Broaching speed is variable (30 to 150 sfm) through rheostat control of the direct current 150 hp motor.

Trunnion-type fixture has hydraulic clamping, positioning, and shuttling. All automatic cycle hydraulic and electrical controls are interlocked, and this equipment is installed according to J.I.C. standards. Table level loading of work and floor level accessibility of the broach inserts and practically all operating parts are important features of the machine. Floor space is 194 x 290 inches.

This is a Colonial Unified Broaching Installation.

Unified Broaching

COLONIAL



TO CLAMP DOWN ON COSTS ... call your Industrial Distributor first

With a local warehouse of Williams Tools at hand *plus* the experienced service of your Industrial Distributor . . . you have a cost-cutting combination that can't be beat. Skilled buyers know that buying the right tools puts the squeeze on costs of production and maintenance jobs. You can depend upon your Williams Distributor for the right tools at the time you need them. The complete line of cost-cutting industrial tools is listed in the new 302 catalog. Write for your copy.

J. H. WILLIAMS & CO.

407 Vulcan Street Buffalo 7, N. Y.

"AGRIPPA" GENERAL SERVICE in 9 sizes with maximum capacities from 2" to 18". Drop-forged swivel and screws have slide pin handle.

Buy the Right Type WILLIAMS DROP-FORGED CLAMP for Every Service

"VULCAN" HEAVY SERVICE in 11 sizes with maximum capacities from ¾" to 12½". Long screws can be providing a minimum capacity of 0.

"VULCAN" MACHINIST'S CLAMPS in 4 sizes with maximum capacities from 1¼" to 4¼". Jaws remain parallel.

"VULCAN" TOOLMAKERS' in 4 sizes each of 2 types. Plain screw 1" to 4¼"; swivel screw ¾" to 4". All screws with wings to permit use of lever in tightening.

DEEP THROAT in 7 sizes with maximum capacities from 2" to 12". Special threaded screws for rapid adjusting. Also in cadmium plate finish to resist welding spatter.

WILLIAMS INDUSTRIAL TOOLS "The Broadest Line of Its Kind" PLUS local service from a Williams Distributor

Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

COUNTERSHAFTS

Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.

COUNTERS, Revolution

Brown & Sharpe Mfg. Co., Providence, R. I
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S. Co., Athol, Mass.

COUNTING DEVICES

Starrett, The L. S., Co., Athol, Mass.

COUPLINGS, Flexible

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.

COUPLINGS, Shaft

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Morgan Engrg. Co., Alliance, Ohio.

CUTTER GRINDERS

See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.

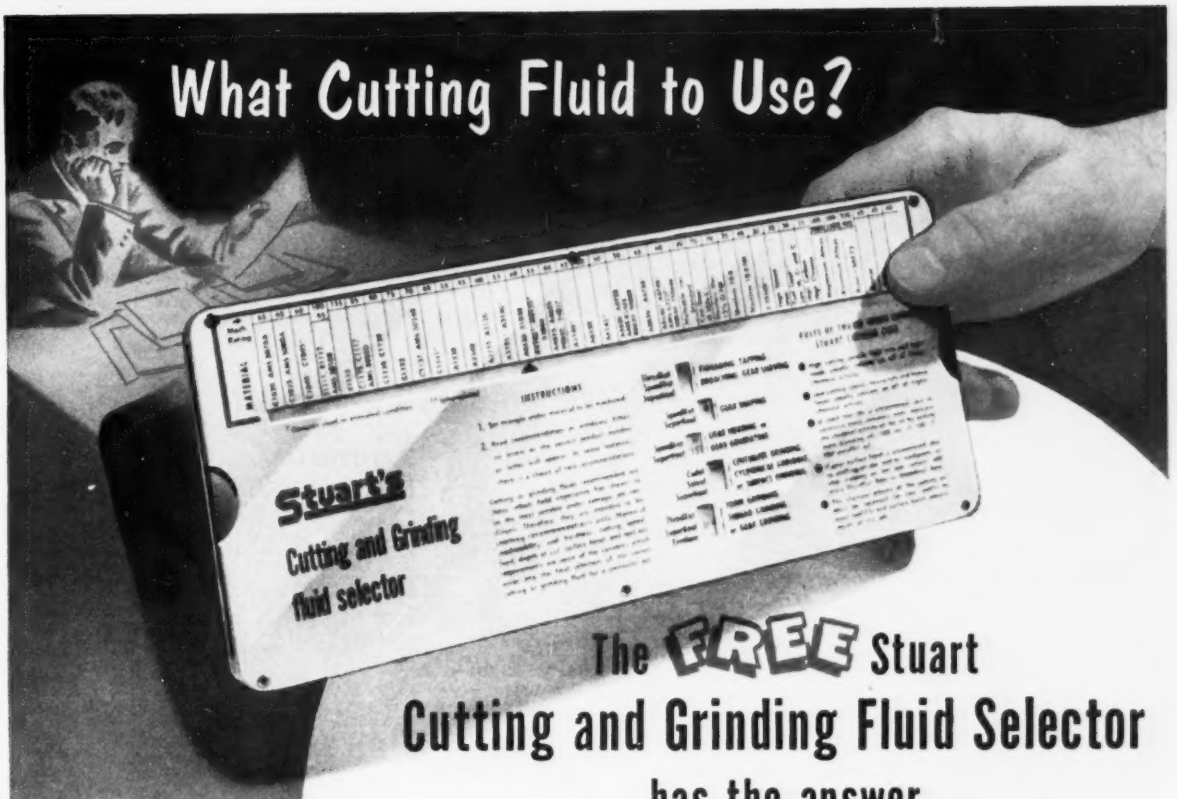
CUTTERS, Gear

Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.

(*Continued on page* 340)

For more information on products advertised, use Inquiry Card, page 247

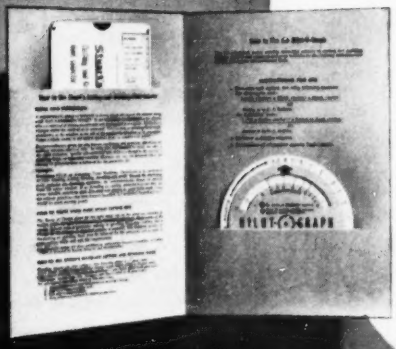
What Cutting Fluid to Use?



The FREE Stuart Cutting and Grinding Fluid Selector has the answer

There is a right cutting fluid for every cutting and grinding job . . . and sometimes it's hard to know where to start in selecting one. For that reason Stuart has developed this FREE Cutting and Grinding Fluid Selector. It's a ready reference that recommends cutting and grinding fluids that field experience has shown to be most suitable under average job conditions. In your hand it's a quick guide to starting recommendations for any job.

Send for your Stuart Cutting and Grinding Selector today. Remember, more than a "coolant" is needed . . . let the Stuart Selector help you get the right cutting fluid to give you the best results.



Stuart's Cutting and Grinding Fluid Selector and Dilut-O-Graph Folder

This handy folder contains a Stuart Cutting and Grinding Fluid Selector and a Dilut-O-Graph . . . a circular slide rule that makes the diluting of cutting fluids quick and easy. They are double-barreled assurance of having the right cutting fluid on all jobs.

send today

CLIP TO YOUR COMPANY LETTERHEAD AND MAIL

D. A. STUART Oil Co. Ltd.
2739 S. Troy St.
Chicago 23, Ill.

Please send the Stuart Cutting and Grinding Fluid Selector and Dilut-O-Graph Folder.

Name_____

Title_____

☐ Have Stuart Representative Call

More Than a "Coolant" is Needed

D. A. Stuart Oil Co.
EST 1865 LIMITED

TIME-TESTED CUTTING FLUIDS AND LUBRICANTS

2727 S. Troy St., Chicago 23, Ill.

In Canada: Canadian D. A. Stuart Oil Co., Ltd.
3575 Danforth Ave., Toronto

Adaptable

TO ANY CUTTING JOB

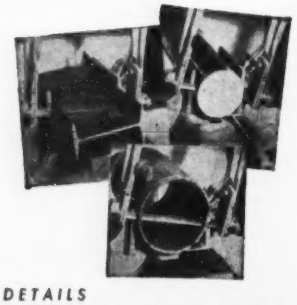
Model J 10" x 18" Capacity

The flexibility of the

JOHNSON BAND SAW

in handling all types of cutting is almost unlimited

Cuts Rods, Tubes, Angles, Heavy Rounds, Flats, Irregular Shapes, Cuts Quickly and Economically



WRITE FOR DETAILS

JOHNSON MANUFACTURING CORP.
ALBION, MICHIGAN

Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Atrax Co., Newington, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429 Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich. (Thread)
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 1440 Woodrow Wilson, Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
OK Tool Co., Milford, N. H.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Verner Hwy., Detroit 1, Mich.

CUTTERS, Rotary

See Files & Burs, Rotary

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

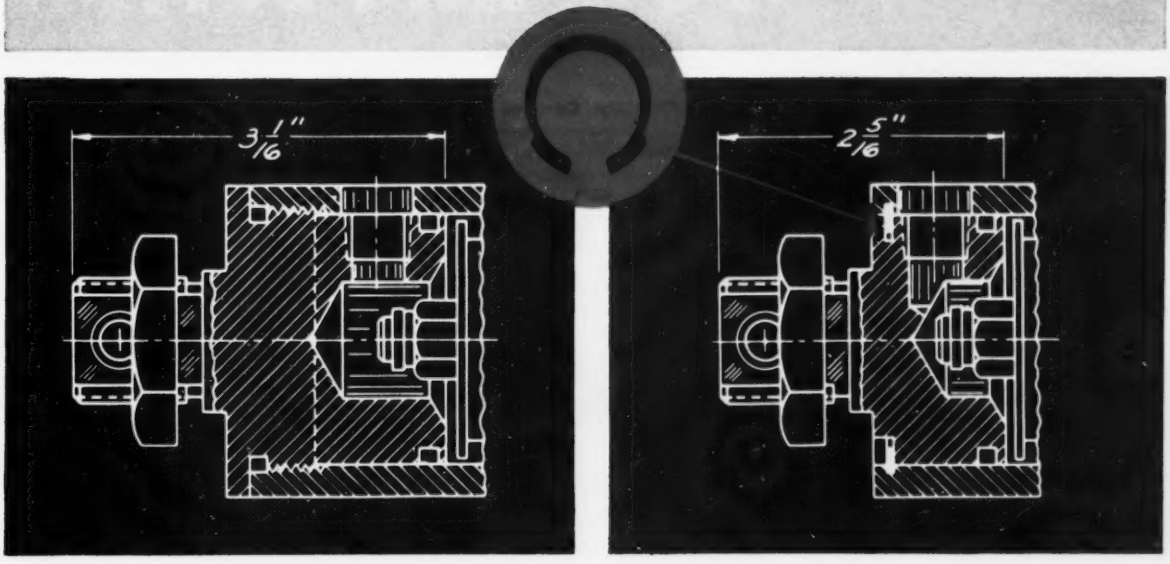
CUTTING AND GRINDING FLUIDS

Cimcool Div., Cincinnati Milling Mch., Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Shear-Speed Chemical Products, Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

(*Continued on page* 344)

For more information on products advertised, use Inquiry Card, page 247

Waldes Truarc Rings Cut Costs $3.26 per Unit, Reduce Size and Weight of Air Cylinder!



OLD STYLE air cylinder, with thread-secured head, required costly tapping, chasing and assembly operations. Also, satisfactory maintenance of packing unit necessitated use of pipe wrenches on painted surfaces.

NEW cylinder head is secured with precision-ground Waldes Truarc Rings. This produces perfect alignment of head within the housing, difficult to obtain with screw-thread seating. Maintenance is quick and easy.

WALDES TRUARC RINGS PERMITTED THESE SAVINGS

Production Time Cut..17 minutes
Weight Saved.....1¾ lb.
Length Shortened.....1½ inches
Cost Saved.....$3.26 unit

■ The A. K. Allen Company of Brooklyn, New York, maker of *AllenAir* cylinders, now uses two Waldes Truarc Inverted Rings (series 5008) to secure heads rigidly within tubes.

■ TRUARC Rings, in this application, are ground parallel by A. K. Allen to .001 tolerance. In a static hydraulic bursting test, the 3" unit (recommended for 350 p.s.i.) withstands a pressure of 2000 p.s.i. And at bursting-point, the brass groove gives way; the Truarc Ring remains intact.

■ Waldes Truarc Retaining Rings are precision-engineered . . . quick and easy to assemble and to disassemble. They can be used over and over again. There's a Waldes Truarc Ring to answer every fastening problem.

■ Find out what Waldes Truarc Retaining Rings can do for you. Send your blueprints to Waldes Truarc engineers.

For precision internal grooving and undercutting . . . Waldes Truarc Grooving Tool

SEND FOR NEW CATALOG

WALDES TRUARC
REG. U. S. PAT. OFF.
RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

WALDES TRUARC RETAINING RINGS AND PLIERS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U. S. PATENTS: 2,382,947; 2,382,948; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,308; 2,509,081; AND OTHER PATENTS PENDING.

M 056

Waldes Kohinoor, Inc., 47-16 Austel Pl., L. I. C. 1, N. Y.

Please send me the new Waldes Truarc Retaining Ring catalog.

(Please print)

Name.....
Title .....
Company .....
Business Address.....
City..... *Zone*..... *State*.....

100% INSPECTION

Quality Control Costs Less with this Federal semi-automatic electronic sorting gage. It simultaneously measures four dimensions of plastic sleeve assemblies . . . divides pieces into four categories: (1) All dimensions good; (2) O.D. oversized; (3) I.D. of holes undersized; (4) rejects.

100% Inspection Pays as this Federal Electronic Sorting Gage automatically measures 8000 roller bearings an hour. It checks their O.D. and length . . . sorts into 12 acceptable classifications 0.0001" apart . . . sends off-size bearings to "scrap" or "salvage".

IS NOW PROFITABLE!

QUALITY VS. COST IS NO LONGER A BATTLE in many mass-production plants. Their process, production and quality control engineers have struck a perfect balance. They did it by installing high-speed measuring, dimensional control and sorting equipment in their production lines.

HOW CAN YOU IMPROVE QUALITY WHILE INCREASING PROFITS? It's easy to find out. Just send for the bulletin "High-Speed Automatic Gaging and Sorting by Federal". It shows how Federal automatic gages are achieving results like these:

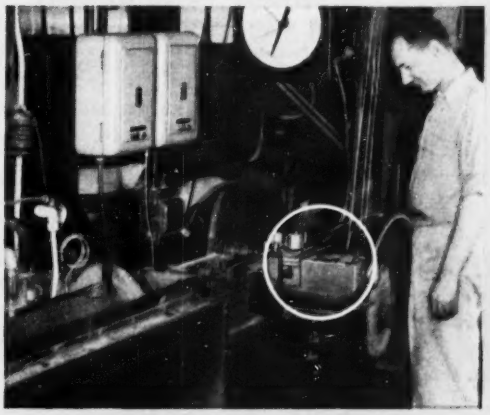
1. **Slashing rejects as much as 35%** while sorting into 16 size categories 0.0001" apart.
2. **Maintaining accuracies of better than 0.00005" all day long** by measuring work in process and automatically adjusting the machine to hold tolerances.
3. **Inspecting and sorting for 9 separate specifications** at a speed of more than 3000 pieces an hour.
4. **Sorting 7200 odd-shaped pieces an hour** into 5 "good" groups while rejecting "bad" pieces for either of two wrong angles.

SEEING'S BELIEVING! These and more than 40 other case studies are covered in detail in Federal's bulletin 72 on "High Speed Automatic Gaging and Sorting". It will help engineers: (1) Federal has already solved your sorting or dimensional control problem; (2) An existing Federal gage may be easily adapted for your purposes; or (3) Federal engineers can develop the gage that will make 100% inspection pay off for you. So, write for your copy today. Federal Products Corporation, 4115 Eddy Street, Providence 1, Rhode Island.

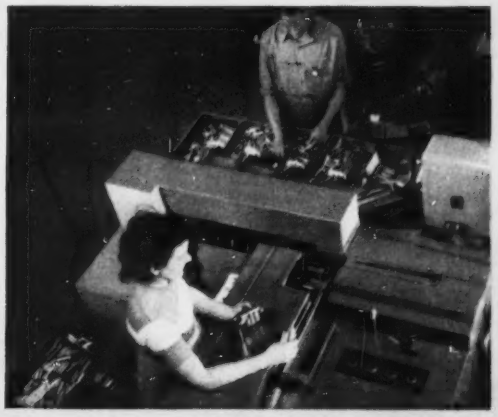
Ask **FEDERAL**

FOR ANYTHING IN MODERN GAGES . . .

DIAL INDICATING, AIR, ELECTRIC OR ELECTRONIC — FOR INSPECTING, MEASURING, SORTING OR MACHINE SIZE CONTROL.



Production is More Uniform with this Federal machine-control, continuous-measuring gage. It automatically speeds up or slows down the wire coating machine to maintain a uniform thickness of plastic or rubber insulation.



Sorting is Faster, More Accurate as this Federal automatic gage measures and sorts automotive piston pins at a rate of more than 3000 an hour. Located at the exit side of a centerless grinding machine, it also directs acceptable pins to packagers.

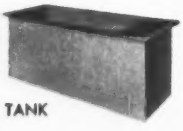
get the best out of your tool steel through

PROPER DRESSING

FORGING HAMMER

FORGING FURNACE

POT FURNACE



QUENCH TANK

TEMPERING FURNACE

TOOL GRINDER

Here is a "Package" that will get rid of a costly and annoying problem . . . In fact, it will save up to 60% of costs for cutting and chipping tools . . . the best life is gotten out of today's steels through proper dressing . . . proper steel, properly treated, will reduce costs substantially. Now, at your own convenience, you can dress as many tools as are needed, and keep close control of your tool inventory.

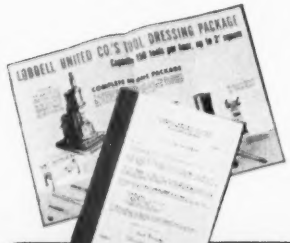
The complete "Tool Dressing Package", entirely engineered by LOBDELL UNITED CO., (subsidiary of United Engineering and Foundry Co.) . . . includes all of the Forging, Heat Treating and Dressing Equipment . . . plus, the practical methods needed . . . and this "Package" not only reduces inventory costs, but it can do this at *low initial cost*, recoverable nominally in one year . . . without special metallurgical control.

The "versatile" NAZEL Electro-Pneumatic Forging Hammer is the LOBDELL UNITED CO. product . . . For the additional equipment presented within this "Package", LOBDELL is joined by a group of the most reputable leaders in their fields:

Heating Equipment by Eclipse Fuel Engineering Company

Tool Grinding Equipment by Black and Decker Company

Accessory Tools and Tool Steels by Bedford Tool and Forge Company



A copy of LOBDELL's new "Tool Dressing Package" Bulletin will give you further details.

LOBDELL UNITED COMPANY

1836-1954 WILMINGTON 99, DELAWARE

A SUBSIDIARY OF UNITED ENGINEERING AND FOUNDRY COMPANY

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Johnson Mfg. Co., Albion, Mich.
Landis Machine Co., Waynesboro, Pa. (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).

CUTTING-OFF MACHINES, Abrasive Wheel

Allison Co., Bridgeport, Conn.
Campbell Mch. Div., American Chain & Cable, 929 Conn. Ave., Bridgeport, Conn.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614 G. N. Lexington Ave., Pittsburgh 8, Pa.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.

CUTTING-OFF MACHINES, Cold Saw

See Sewing Machines, Circular

CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob Bros. Grafton, Wis.

CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CUTTING-OFF WHEELS, Abrasive

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

CYLINDERS, Air

Hannafin Corp., 1101 S. Kilbourn Ave., Chicago.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.

(*Continued on page* 346)

For more information on products advertised, use Inquiry Card, page 247

WHAT DOES FIRTH STERLING OFFER YOU?

(ANSWER NUMBER 4)

RESEARCH THAT ANTICIPATES TOMORROW'S NEEDS

Our objective is to help *you* solve the technical and metallurgical problems of an *atomic* age *before* they arise . . . not *after*. So, at Firth Sterling, constant emphasis is on full-scale research, development, and production in specialty steels, carbides, new metals, and new methods.

Out of this determination to be ahead, not just abreast of need, has come this amazing three year record of achievement in *your* interest:

- A method of heat tinting that makes *Color Metallography* practical for determining the exact structure-property relationship of carbide mixtures.*
- New metals of great present and future potential that include heavy metal, three grades of chromium carbide, titanium carbide, and high temperature alloys.
- Cermets—those amazing hybrids of ceramic and metal, possessing in *combination* the best characteristics of each, to overcome modern technological problems.
- Zirconium—in ingot, billet, bar, rod, strip, sheet, wire, and tubing form—soon to be available for industrial applications.
- A new chemical plant, employing the most advanced processes and equipment, producing ammonium paratungstate of the highest *purity* to improve the quality of our tungsten carbides.
- Method "X"—an electro-mechanical process for machining metals that are unmachinable by conventional means.

Yes, all these are the result of "accent on research" . . . the justification for our statement

Firth Sterling Stands for Metallurgical Achievement—Past, Present, Future

*Write for reprint of article from Oct. 19, 1953 issue of STEEL.

I-4

A mule is a hybrid

So is a CERMET

A CERMET is what scientists the world over want—a hybrid material, like the mule, but possessing in combination all the best characteristics of several materials which by themselves cannot fill the demands of twentieth century technology.

In the forefront of the race for the jet-era hybrid is a CERMET. A mule of materials, CERMET results from mating a ceramic material with a metal. Thus, the name CERMET. Its physical characteristics are such that research men *everywhere* are striving for its perfection.

You see, man has reached a point where advancement in some directions is limited by the "survival" characteristics of existing materials. Jet propulsion, for example, may soon be stymied by the disintegration of available materials under high stress. Involved in this modern-day trial-by-fire are such technicalities as catastrophic oxidation, thermal shock failure, non-resistance to impact and "creep"—which is elongation under high temperature and stress.

Firth Sterling is now producing CERMETS for *many* applications!

But, mule-like, CERMETS have some stubborn little characteristics which must be "bred out" before the ultimate "wonder" hybrid emerges. We are sure it will emerge from blue-ribbon breeding . . . because Firth Sterling stands for metallurgical achievement . . . past, present and future.

R-291

Firth Sterling

—INC—

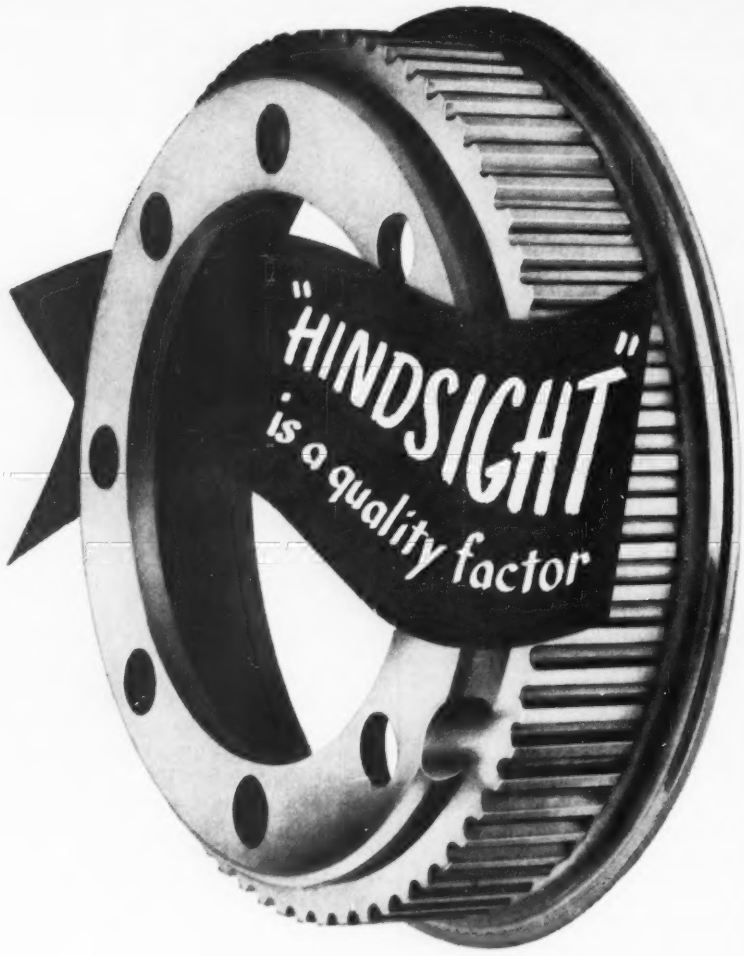
GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

OFFICES* AND WAREHOUSES: BIRMINGHAM* CHICAGO CLEVELAND DAYTON* DETROIT HARTFORD HOUSTON* LOS ANGELES NEW YORK* PHILADELPHIA* PITTSBURGH* WASHINGTON* WESTFIELD, N.J.*

PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets

For more information on products advertised, use Inquiry Card, page 247



in Perkins custom-made Gears

We have manufactured precision gears to customers' specifications for over thirty years. This collective experience enables us to approach any gear engineering problem with a vast amount of "hindsight." For no matter how exacting your particular requirements may be, they cannot exceed those of many of our regular customers. The return of a buyer's market places a premium on quality. And if — in the product you manufacture, quality is synonymous with trouble-free power transmission — our gear engineering service will be of great value to you right now. Ask us for suggestions, ideas and cost estimates today.

PERKINS MAKES: helical gears, bevel gears, sprockets, ratchets, worm gears, spiral gears, spur gears with shaved or ground teeth, ground thread worms.

NOTE 1: A new product is the Perkins Precision Spring Coiler. This coiler (patent applied for) turns out precision springs — any type, shape, size, from wire sizes .005 to .125.

2: Another new product — the Perkins "Bendit 15" — a patented metal forming machine bends and shapes sheets, rods; strips tubing into innumerable complex as well as simple forms that would be difficult or impossible to make by other means. Eliminates need for expensive tools or specialized skills. Ht. 47", net wt. 200 lbs. Write today for descriptive catalogs, prices etc.

PERKINS Machine & Gear Co.
WEST SPRINGFIELD, MASSACHUSETTS

National Forge & Ordance Co., Irvine, Warren County, Pa.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DEALERS, Machinery

Botwinik Bros. of Mass., Inc., 14 Sherman St., Worcester, Mass.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Taft-Pierce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Inc., Worcester, Mass.

DESIGNERS, Machine and Tool

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Hartford Specialty Mchry. Co., 287 Homestead St., Hartford, Conn.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DIAMONDS AND DIAMOND TOOLS

Smit, J. K., & Sons, Inc., Murray Hill, N. J.

DIE-CASTING

See Castings, Die

DIE-CASTING MACHINES

Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Verson Allsteel Press Co., 93rd St. and S Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DIEMAKERS' SUPPLIES

Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

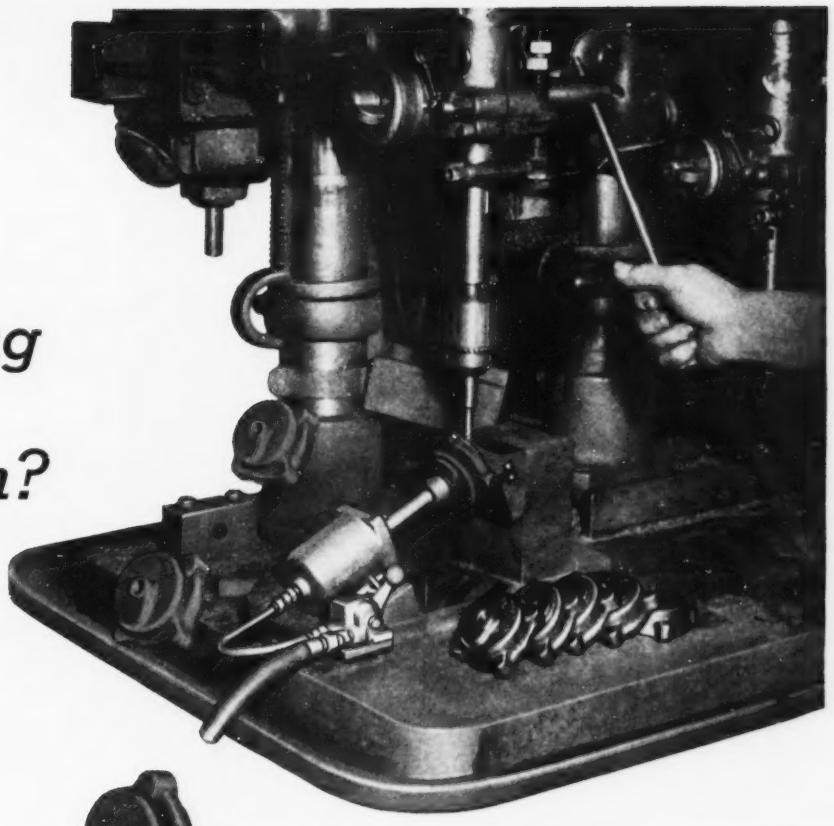
DIEMAKING MACHINES

Grob Bros., Grafton, Wis.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Moumee St., Adrian, Mich.

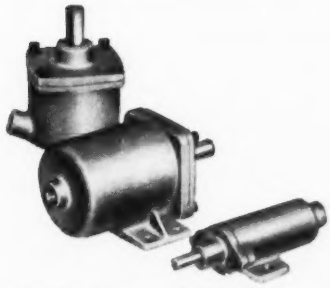
(*Continued on page* 348)

For more information on products advertised, use Inquiry Card, page 247

Clamping Problem?



SCHRADER has the answer!



Schrader Air Clamping Cylinders are available either base or leg mounted, in 1", 2¼" and 3" diameters delivering a 2" or 1" stroke. A wide selection of Schrader Valves is available to operate this equipment.

Schrader

REG. U. S. PAT. OFF.

Leaders in air control since 1844

The **Schrader Air Clamping Cylinder** is actually a bantam air cylinder that can *add several minutes* to each worker's production hour . . . eliminate the need for slow, manual clamps.

Think of all the clamping operations in your own shop. Milling machines . . . drill presses . . . power presses . . . welders . . . gluers – and many dozens of other machines that are now idling for ten or fifteen seconds while operators go through slow clamping operations. Why not save time – and operator annoyance – with fast, convenient Schrader Clamping Cylinders, as so many other industrial plants have already done? Remember, you can mount these Schrader Clamping Cylinders anywhere – and actuate them automatically or manually.

For full details on the models available – or any of the hundreds of air control products in the complete Schrader Line – write today. Or, if you prefer, fill out the coupon below.

A. Schrader's Son
Division of Scovill Manufacturing Company, Incorporated
454 Vanderbilt Avenue, Brooklyn 38, N. Y., Dept. T-5

I am interested in more information on _____

Name _____ Title _____

Company _____

Address _____

In a four month period under actual competitive conditions one Diamond Wheel ground 36,976 pieces, while eight silicon carbide wheels ground a total 16,023 pieces.

RESULT— 1. Less cost per piece 2. Greater Production 3. Less down time.

See for yourself how

SECOMET DIAMOND WHEELS

can provide you with these plus values

Send for informative catalog #54 or contact us direct for information and assistance.

J. K. SMIT & SONS, INC.

MURRAY HILL, N. J.

DIE SETS, Standard

Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.
Wales-Strippit Corp., N. Tonawanda, N. Y.

DIE-SINKING MACHINES

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DIE-SINKING PRESSES

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.

DIE STOCKS

See Stocks, Die

DIES, Sheet Metal, Etc.

Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krupp Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
John B., Manufacturing Co., Ellis St., New Britain, Conn.
Metal Carbides Corp., Youngstown, Ohio.
Niagara Mch. & Tool Wks. 683 Northland Ave., Buffalo, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit Corp., N. Tonawanda, N. Y.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl., Chicago 12, Ill.

DIES, Threading

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Winter Bros. Co., Rochester, Mich.

DIES, Threading, Opening

Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co., Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

DIES, Thread Rolling

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

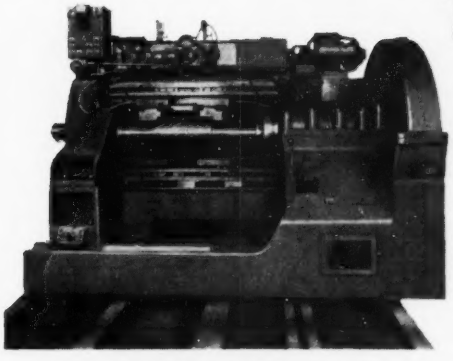
(*Continued on page* 350)

For more information on products advertised, use Inquiry Card, page 247

Versatility!

YOU CAN MAKE ALL THESE GEARS ON ONE MACHINE

Continuous-tooth herringbone gear
Single helical gear
Double helical gear with staggered teeth
Straight-tooth (spur) gear
Double helical, staggered-tooth gear with center groove
Herringbone rack and pinion
Gear component with integral shaft
Cluster gear



FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Cambridge (Mass.), Akron, Cleveland, Chicago, Los Angeles, Houston

Reduce MANUFACTURING COSTS— THROUGH FASTER CUTTING!

The gears you see above are only some of a wide variety of precision gears and parts that you can make on a Farrel-Sykes "Twin-Head" generator.

Manufacturing costs will drop as the unequalled speed, accuracy and convenience of this machine keeps production flowing fast. Setups and change-overs are effected so rapidly that down-time is held to a minimum. Operators prefer the machine for its ease of operation, such as rapid selection of speeds and feeds, simple adjustment of cutters, and positive control of infeed.

Write now for details of this versatile gear generator. You will find it profitable in your shop.

Farrel-Birmingham ®

FB-921

REED RD

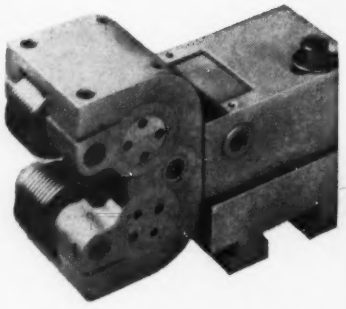
Facts about Thread Rolling

it will pay you to know

Thread Rolling . . . as a Primary Operation

with Reed Thread Rolling Attachments on Automatic Screw Machines

Reed Thread Rolling Attachments are currently built in four popular standard sizes and designed to operate in more than 300 cross-slide positions on over 100 sizes of automatic screw machines. Each size is adjustable to accommodate an infinite range of work diameters within its capacity and consists of two units . . . a head of compact rigid design assembled to an adapter by a floating swivel connection.



Thread Rolling . . . as a Secondary Operation

with Reed Cylindrical Die Thread Rolling Machines

Reed Cylindrical Die Thread Rolling Machines, using three dies, have made possible interchangeable manufacture of threads on component parts where close tolerances once made selective assembly a costly requirement. Standard vertical and horizontal machines provide for a wide variety of applications on various work diameter capacities up to 4 inches.

REED ROLLED THREAD DIE CO.

THREAD ROLLING MACHINES and DIES • KNURLS • THREAD ROLLS

Worcester, Massachusetts, U. S. A.

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif, Detroit, Englewood, N. J., Houston Indianapolis, Milwaukee, Montreal, New York City, Philadelphia, Pittsburgh, St. Louis, Syracuse, Toronto

029A

DISCS, Abrasives

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

DISINTEGRATORS

Elox Corp., 602 N. Rochester Rd., Clawson, Mich.

DIVIDING HEADS

See Indexing and Spacing Equipment

DOWELL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRAFTING MACHINES

Universal Drafting Mch. Corp., 7960 Lorain Ave., Cleveland, Ohio.

DRESSERS, Grinding Wheel

Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio.
El-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hoglund Engrg. & Mfg. Co., Inc., Berkeley Heights, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Meyers, W. F. Co., Bedford, Ind.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.
Western Tool & Mfg. Co., 1640 E. Wheeler St., Springfield, Ohio.

DRIFTS, DRILL

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

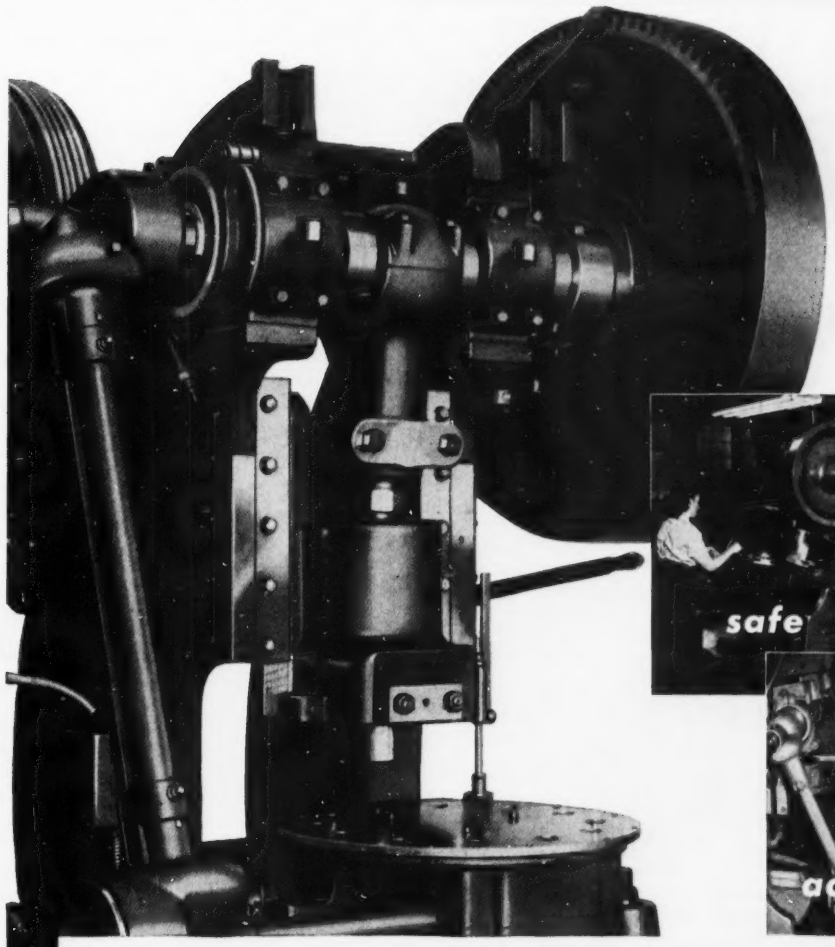
DRILL HEADS, Multiple Spindle

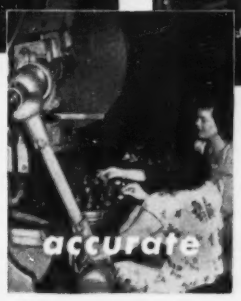
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
Govro-Nelson Co., 1933 Antoinette St., Detroit 8, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

(*Continued on page 352*)

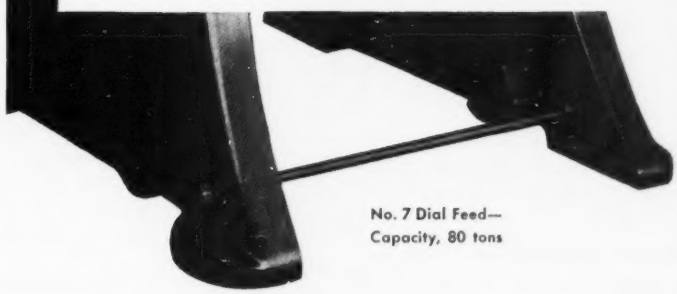
Now's the time to discard
costly, obsolete methods . . . replace with FEDERALS for

more profitable presswork!





FEDERAL DIAL FEED PRESSES



No. 7 Dial Feed—
Capacity, 80 tons

Don't let obsolete methods and equipment handicap your operation, drain your profits. Modernize with new Federal Dial Feed Presses. Then watch your production go up, and costs go down! Surveys show many a Federal Dial Feed doing three to five times the work of a standard press . . . cutting down-time, reducing accidents, eliminating more expensive equipment. These rugged, precision-built, versatile presses incorporate the finest materials and workmanship. Available in eight sizes, from 6 to 80 ton capacity. Automatic feeds and ejectors if desired.

Write for new Dial Feed Catalog

THE FEDERAL PRESS COMPANY
505 Division Street, Elkhart, Indiana

For more information on products advertised, use Inquiry Card, page 247

Magna-Lock MAGNETIC CHUCKS AND DEVICES . . .

MAGNETIC CHUCKS

RECTANGULAR

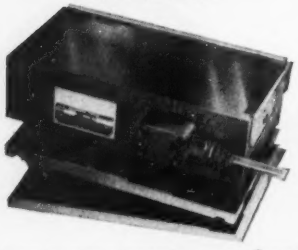
SWIVELING

ROTARY

A type and size for any machining operation on flat or irregular surface.

Rectangular chucks from 5"x10" to 30"x96" working surface. Rotary chucks from 6¼" dia. face to 72" dia. Swiveling chucks from 5"x10" to 12"x84". *All-steel* construction, moisture-proof, shock-proof. 22% *more* magnetic area. Pieces held to extreme edges of chuck.

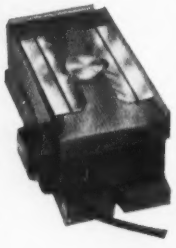
SINE CHUCKS



The answer to greater speed and accuracy in setting up for angular grinding.

Easy to use . . . no dials or scales. Standard gauge blocks insure accuracy impossible by any other means. Working surface 6" x 11½", also 6" x 20" Table of Constants furnished.

MAGNA-VISE



Holds non-magnetic materials on magnetic chucks — brass, copper, plastic, hard rubber, stainless steel, aluminum, glass, etc. Available in 6", 10" and 14" lengths.

ENGINEERING FACILITIES • CHUCK REPAIR

Take advantage of Magna-Lock's experience and engineering "know-how" . . . at your service to help you solve your chucking problems.

Magna-Lock offers you the most complete chuck repair service available anywhere. Any type and make of electrical magnetic chuck. Fast, dependable service at reasonable cost.

MAGNA-LOCK ACCESSORIES

For use with Magna-Lock chucks, these accessories meet the high quality standards of the chucks themselves. Demagnetizing units, voltage regulator, demagnetizing and reversing switch, rectifiers.

• • •

Bring your chucking problems to Magna-Lock . . . first to increase your machines' productivity. Write M-54.

Request Magna-Lock as original equipment on your new machines.

Hanchett
MAGNA-LOCK CORP.
Magnetic Chucks and Devices
BIG RAPIDS, MICHIGAN, U.S.A.

MAGNA-LOCK, INC.
Magnetic Chucks and Devices
BIG RAPIDS, MICHIGAN, U.S.A.

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Keller Tool Co., Grand Haven, Mich.
Kingsbury Mch. Tool Corp., Keene, N. H.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLING MACHINES, Automatic

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros. Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Wales-Strippit Corp., N. Tonawanda, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Thor Power Tool Co., Aurora, Ill.
Walker-Turner Div., Kearney & Treckar Corp., 900 North Ave., Plainfield, N. J.

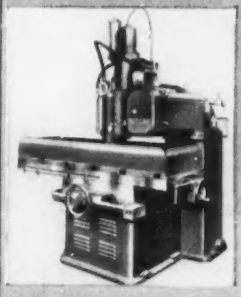
DRILLING MACHINES, BOILER

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

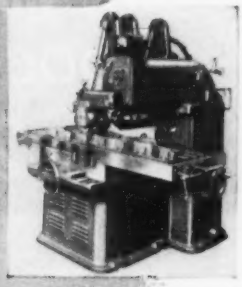
(*Continued on page* 354)

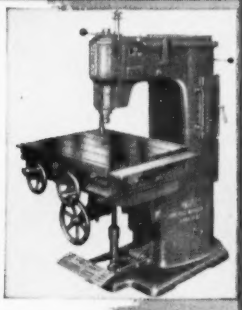
For more information on products advertised, use Inquiry Card, page 247

for high speed non-ferrous milling



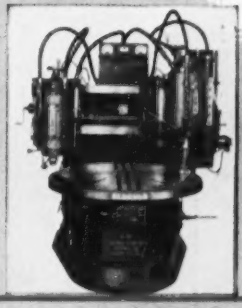
Onsrud A-24 Milling Machines . . . high HP, high speed milling heads, remove metal at rates up to 2½ cubic inches per minute. Table feeds infinitely variable from 11" to 215" per minute. 3,450 RPM horizontal head pivot mounted for contour milling with profile bar control. Write for Bulletin 1139.

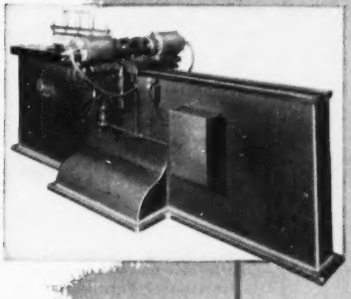




Onsrud A-245 Vertical Milling Machine . . . for light work, manually fed as in sheet profiling and cut-out operations. Two speed 7,500 and 15,000 RPM spindle provides smooth finish and fast production.

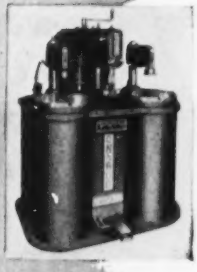
Onsrud A-48 Rotary Table Face and Profile Milling Machine . . . for work or work set-up, up to 48" diameter. One pivoted head follows profile bar for contour or straight milling. Second head is preloaded for face milling.





Onsrud A-242 Duplex Milling Machine . . . mills parallel faces on work at one time, using end milling cutters. A high precision machine, built with one, two, or more motors as specified. Write for Bulletin 1128.

Onsrud A-18 Rotary Table Profile Milling Machine . . . dual table design permits loading while second table is in operation. For continuous production. Write for Bulletin 1124.



There's an Onsrud high speed, high HP, fast feed milling machine for every type of non-ferrous milling . . . to meet the requirements of every type and size of production part. Your inquiry is invited.

ONSRUD MACHINE WORKS, INC.
3940 Palmer Street • Chicago 47, Illinois

Onsrud

the fastest machines in metal working

want to

Increase
THE TIME BETWEEN
TOOL DRESSINGS
25%

This Sharples Cutting Oil Purifier assures longer runs between set up and tool dressing...

this is just one of many savings from low cost, high efficiency Sharples oil purification.

A Sharples Cutting Oil Purification System Pays off. Write for Bulletin 1270 for the answers to your question, "Should I Purify Cutting Oil in My Shop?"

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Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
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Pratt & Whitney, West Hartford 1, Conn.
Wales-Strippit Corp., N. Tonawanda, N. Y.

DRILLING MACHINES, Gang

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

DRILLING MACHINES, Horiz. Duplex

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DRILLING MACHINES, Horizontal Portable

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

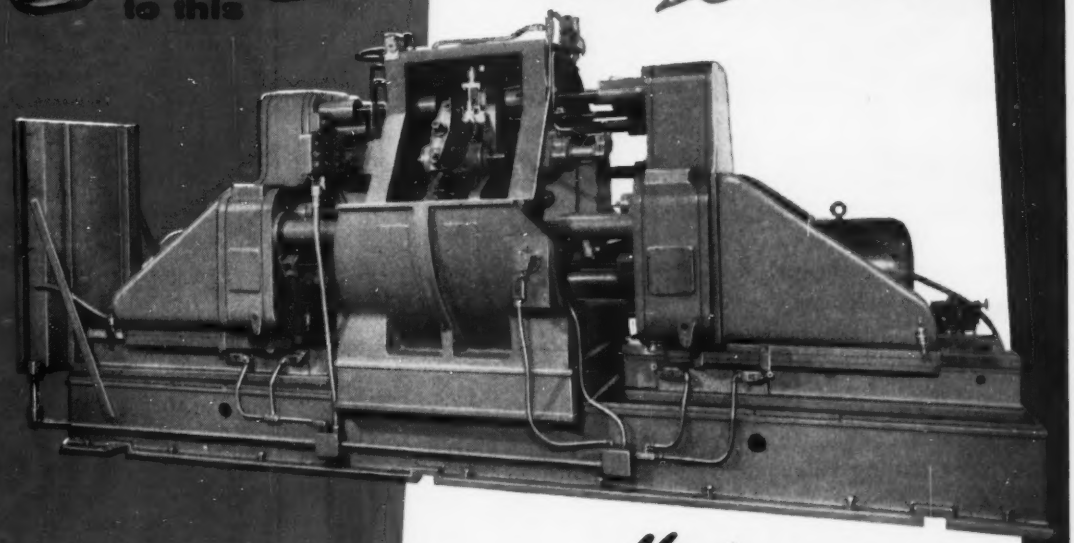
DRILLING MACHINES, Inverted

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

(*Continued on page* 356)

For more information on products advertised, use Inquiry Card, page 247

...in just 23 seconds!



with this *Morris* mor-speed production machine

STATION	OPERATIONAL CYCLE:
1	Double Load and Unload
2	Drill four 1" holes
3	Re-drill holes to 1 7/16"
4	Rough face four holes
5	Finish face four holes
6	Chamfer four holes

The Morris Two Way Horizontal High Production Machine finishes universal joint flange yokes at the rate of 153 per minute at 100% efficiency.

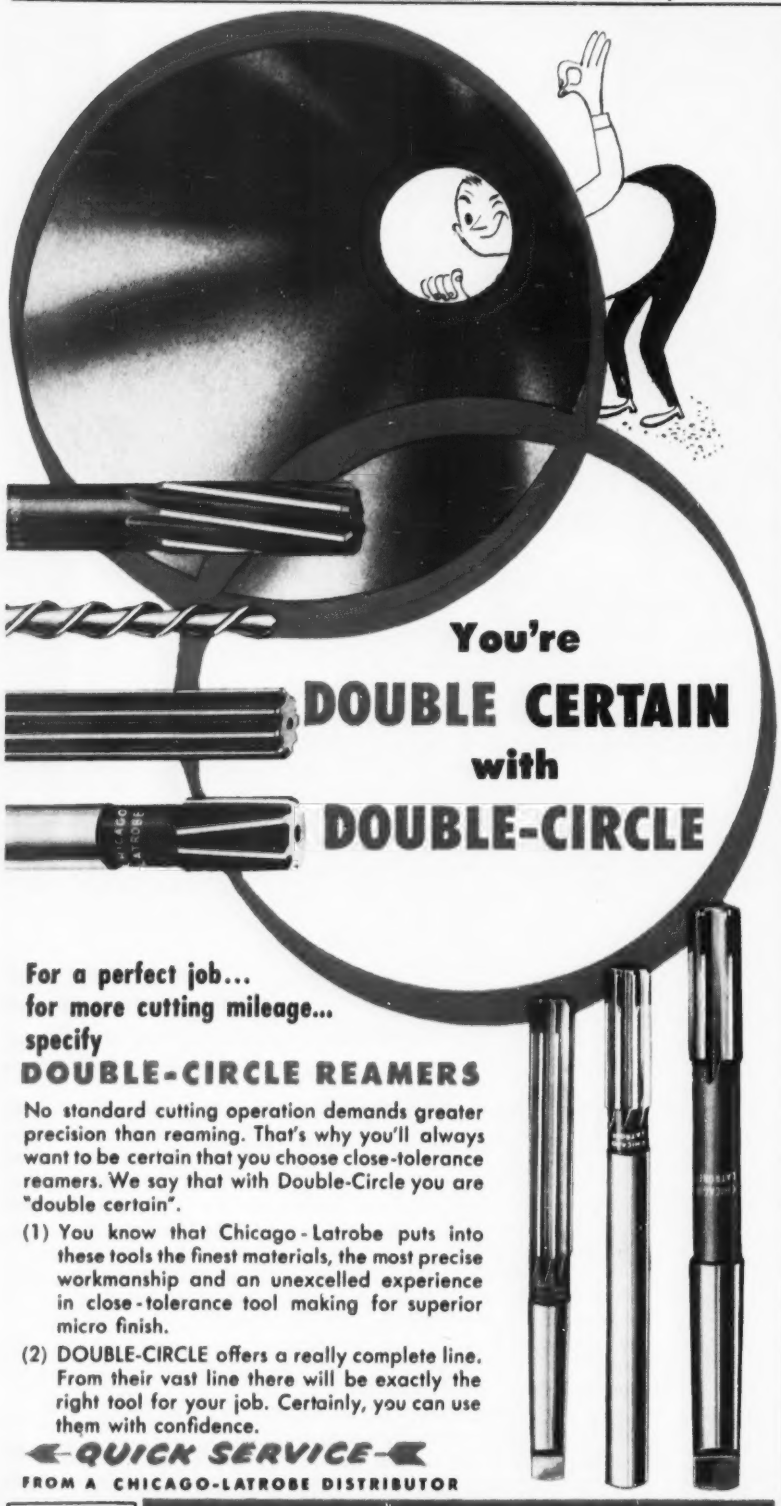
It, like other Morris MOR-SPEED Machines, is made up of standard MOR-SPEED units plus certain special parts. Because of Morris methods and standard designs, the user gets a special purpose machine . . . capable of high speed, precision production . . . without the usual sky-high cost and limited application of a "special machine."

Morris MOR-SPEED Machines save space, time and costs for leading manufacturers in every industry.

If you have multiple drilling, tapping, boring or similar operations on a mass production basis, Morris Engineers may may be able to show you substantial savings on a modest investment.

Morris

THE MORRIS MACHINE TOOL CO.
946 HARRIET STREET
CINCINNATI 3, OHIO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DOUBLE CERTAIN
with
DOUBLE-CIRCLE
For a perfect job...
for more cutting mileage...
specify
DOUBLE-CIRCLE REAMERS
No standard cutting operation demands greater precision than reaming. That's why you'll always want to be certain that you choose close-tolerance reamers. We say that with Double-Circle you are "double certain".
(1) You know that Chicago-Latrobe puts into these tools the finest materials, the most precise workmanship and an unexcelled experience in close-tolerance tool making for superior micro finish.
(2) DOUBLE-CIRCLE offers a really complete line. From their vast line there will be exactly the right tool for your job. Certainly, you can use them with confidence.
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FROM A CHICAGO-LATROBE DISTRIBUTOR
DOUBLE CIRCLE TOOLS
CHICAGO-LATROBE
417 W. ONTARIO ST. CHICAGO 10
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DRILLING MACHINES, Multiple Center Column Type

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

DRILLING MACHINES, Multiple Spindle

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool Mfg. Co., 3743 Durango Ave., Los Angeles 34, Cal.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortand, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry, Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kaukauna Machine Corp., Kaukauna, Wis.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLING MACHINES, Rail

See Drilling Machines, Gang

DRILLING MACHINES, Sensitive

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

(*Continued on page 358*)

For more information on products advertised, use Inquiry Card, page 247

Through specialization, Card is better prepared to fulfill your most exacting threading requirements.

TAPS *by* CARD

Completely stocked offices at Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco and Seattle

See your local Card distributor for prompt deliveries and helpful service

S. W. CARD MANUFACTURING CO., MANSFIELD, MASS. • DIVISION OF UNION TWIST DRILL CO. **TAPS • DIES • SCREW PLATES**

MICRO JAW-SET

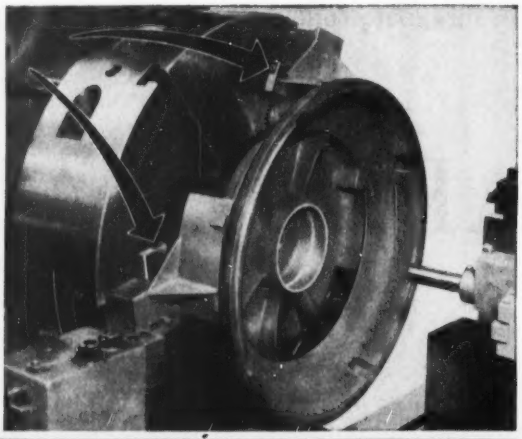
PAT. APPLIED FOR

for precision adjustment of lathe chucks

Designed for easy installation on any top jaw used on an American Standard Serrated Jaw Chuck. Top jaws are then interchangeable on any chuck of American Standard Serrated type. Precision adjustment is made by using the hex wrench furnished with the Jaw-Set. Only one screw is required to control microadjustment.

The rigidity of a non-adjustable chuck plus complete precision adjustment of each jaw!

The Potter and Johnson Co., of Pawtucket, R. I. was the first machine tool builder to recognize the advantages of the Whiton Micro Jaw-Set used in combination with Whiton Air Chucks. This 24" Whiton Air Chuck is mounted on a 6D Potter & Johnson Automatic Turret Lathe tooled for quantity production of motor end shields. The operator can make microadjustment of any jaw with the Jaw-Set. Jaws can be set precisely concentric for second operation work.



Whiton SINCE 1856

Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippit Corp., N. Tonawanda, N. Y.

DRILLING MACHINES, Upright

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Orban Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippit Corp., N. Tonawanda, N. Y.

DRILLING MACHINES, Wall, Radial

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS, Center

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Keo Cutters, 19326 Woodward, Detroit, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

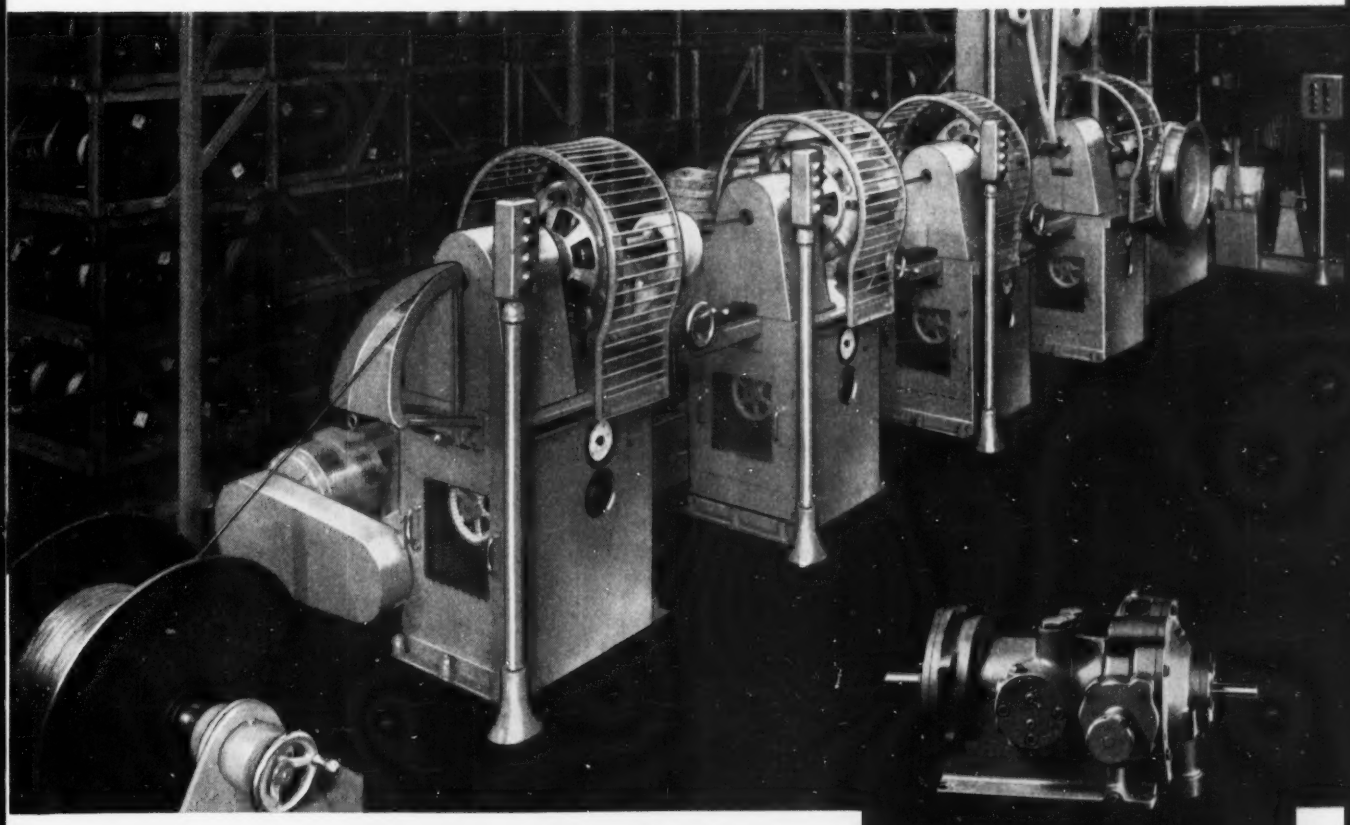
DRILLS, Core

Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Erickson Tool Co., 2909 Hamilton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

(*Continued on page 360*)

For more information on products advertised, use Inquiry Card, page 247

MACHINE DESIGN AT WESTERN ELECTRIC



Its use of Oilgear Fluid Power

Western Electric Company, manufacturing unit of the Bell Telephone System, originates, designs and builds many of the special machines it uses in its own manufacturing processes. It also maintains unceasing pressure to improve upon machines already in operation, for optimum performance, for better product, for lower costs, for freedom from trouble.

Its use of Oilgear Fluid Power Drives and Transmissions has been increasing because, in the words of their engineers, Oilgear enables them among other things to synchronize many machine components easily and economically. A good example of all these points is the "short haul" video cable wrapping machine pictured above.

This machine was designed and built by the company's own men some years ago. For optimum performance, the speed of the heads should be easily and independently variable and the direction of rotation instantly changeable because the lay and pitch of the wrappings must be varied according to the requirements of the run. Moreover, the inside contour of the tube formed by the wrapping should be smooth and uniform so as to avoid setting up echo waves that interfere with transmission and vitiate signal strength.

Because of these requirements, a new drive was installed something over 4 years ago. A line shaft drives five Oilgear Fluid Power Transmissions, one at each machine head and the capstan.

The results were these: uniformity and control of tension are so good, the machine runs at 4 times its former machine speed; it is easy to vary speed and direction of rotation of each individual head; eccentric heads gave way to concentric heads, and supply spools are now loaded to full capacity instead of ¼th to ⅛th as before; the machine is stopped less frequently for loading. Maintenance on the former drive was involved and frequent—on the Oilgear equipment it has been simple and negligible.

There is some reason to suspect that Oilgear Fluid Power with its wide range of advantages may solve some of *your* machine design problems and make the results very pleasing and profitable. Why don't you really find out? THE OILGEAR COMPANY, West Pierce Street, Milwaukee 4, Wisconsin.

OILGEAR

OILGEAR

SOLVED...

The Problem of Driving the Pump from a Reversing Shaft without Changing Direction of Flow or Port Positions

New Tuthill Catalog No. 105 Provides the Facts You Need on Automatic Reversing Pumps

How to lubricate reversing machinery! How to provide coolant or hydraulic power when the pump must be driven from a reversing shaft! How to insure pump flow in the proper direction on machinery which must be shipped without knowing the ultimate direction of the driving members!

The answers to questions like these are presented in this new Catalog No. 105 on Tuthill Automatic Reversing Pumps. Through a unique feature developed by Tuthill, these pumps can be driven in either direction of rotation without changing direction of flow or port positions. The wide range of types, sizes, and pressures makes these pumps readily adaptable to your requirements. Capacities up to 200 g.p.m. and pressures to 400 p.s.i.

TUTHILL PUMPS FOR THE PURPOSE

Write for your copy of Catalog No. 105 today

TUTHILL PUMP COMPANY
Dependable Rotary Pumps since 1927
939 East 95th. St., Chicago 19, Ill.

Canadian Affiliate: Ingersoll Machine & Tool Co., Ltd. Ingersoll, Ontario, Canada

Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
McCosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8,Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DRILLS, Deep Hole

Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Miss.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Black & Decker Mfg. Co., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
Ryerson Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.

DRILLS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Thor Power Tool Co., Aurora, Ill.

DRILLS, Rachet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist

Besley-Welles Corp., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRIVES, Chain

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

(*Continued on page 362*)

For more information on products advertised, use Inquiry Card, page 247

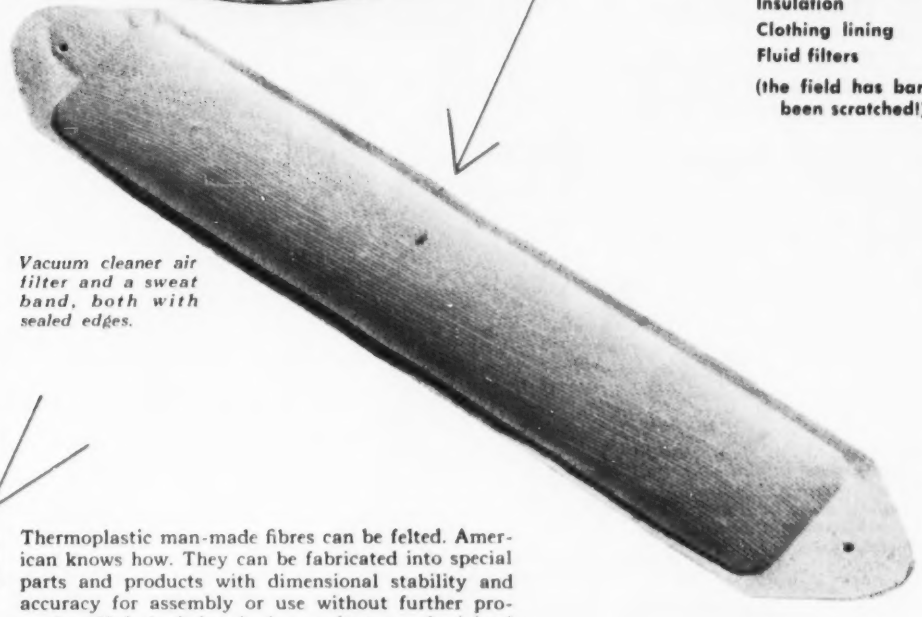
SCIENCE MAKES POSSIBLE

FUSED EDGES

U. S. PATS: 2521984 2521985

Some Present Uses

Dust shields
Vacuum cleaner filters
Powdered soap containers
Face powder pads
Insulation
Clothing lining
Fluid filters
(the field has barely been scratched!)



Vacuum cleaner air filter and a sweat band, both with sealed edges.

Thermoplastic man-made fibres can be felted. American knows how. They can be fabricated into special parts and products with dimensional stability and accuracy for assembly or use without further processing. If desired, fused edge products can be joined to other fabrics instead of by the conventional methods of stitching, adhesives or clamping. The felt within the edges can have any desired porosity, or density characteristics, within wide limits, since such felts can be made entirely of manufactured fibres, or contain mixtures of natural and man-made fibres. Thus these fused-edge felts have great versatility, and are capable of rendering many different services. It will pay you to look into what fused-edge felt products and parts can do for you. Write for information on your company letterhead.

American Felt Company

TRADE MARK

68 GLENVILLE RD. GLENVILLE, CONN.

DUPLICATORS
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Richford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois, Detroit, Mich.

DUST COLLECTORS
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Kindt-Collins Co., 12653 Elmwood Ave., Cleveland 11, Ohio.
Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS
Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT
General Electric Co., Schnectady 5, N. Y.

EMERY WHEEL DRESSERS
See Dressers, Grinding Wheel

EMERY WHEELS
See Grinding Wheels

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Geo., Mch. Co., 1110 W. 13th St. Racine, Wis.

EXTRACTORS, Screw
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

High Speed
CONTINUOUS OIL GROOVING
500 PIECES PER HOUR!

High-production and economical operation are the features of the WICACO CONTINUOUS OIL GROOVER . . . capable of completing as many as 500 grooved pieces per hour in routine practice—even with unskilled labor!

The operator loads and unloads the work **without stopping the Machine**—a valuable time-saving advantage made possible by the WICACO upright construction of the spindle and stationary chuck. Feed-lever automatically returns to neutral position when cutting tool reaches its proper depth. The spindle—not the chuck—revolves, permitting fast and convenient grooving of a variety of larger and irregular work. Maximum depth of groove 7/32", maximum width 3/8"; grooves may be cut in work from 1/4" I.D. to 4 1/2" I.D.; standard chuck holds work to 4⅓" O.D.; stroke of spindle from 0" to 7"; floor space 24" dia.; weight of machine about 950 lbs.

Send us sample bearings to cut to specifications. We will return them, properly grooved, with a record of the time required and a cost-estimate. No obligation. Or, write for detailed, well-illustrated Bulletin.

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SINCE 1868
THE WICACO MACHINE CORPORATION
WAYNE JUNCTION PHILADELPHIA 44, PA.

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Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.

FANS, Exhaust, Electric Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
General Electric Co., Schneectady 5, N. Y.

FEEDS FOR PRESSES, Automatic
Federal Press Co., 600 Division and Big Four R. R., Elkhart, Ind.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FELT, For All Applications
American Felt Co., Glenville, Conn.

FILES, Hack
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Heller Bros. Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence, R. I.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Machine
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILES AND BURS, Rotary
Atrax Co., Newington, Conn.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Jarvis, Chas. L., Co., Middletown, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Thor Power Tool Co., Aurora, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES, Dies, Etc.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Grab Bros., Grafton, Wis.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Air
Keller Tool Co., Grand Haven, Mich.

FILTERS, Coolant and Oil
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Cuno Engrg. Corp., Meridan, Conn.
Industrial Filtration Co. (Delpark Corp.) 15 Industrial Ave., Lebanon, Ind.

FINISHES FOR MACHINES AND METAL PARTS
Lowe Bros. Co., Dayton, Ohio.
Ransburg Electro-Coating Corp., 1234 Barth, Indianapolis 7, Ind.

FLEXIBLE COUPLINGS
See Couplings, Flexible

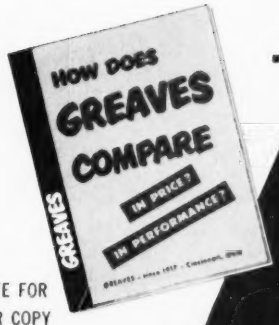
FLEXIBLE SHAFT EQUIPMENT
Jarvis Chas. L., Co., Middletown, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

FORGINGS, (Upsetting) Machines
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

(*Continued on page 364*)

COMPARE

. . . PRICE! . . . FEATURES! . . . PERFORMANCE!



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WRITE FOR YOUR COPY OF THIS EYE-OPENING COMPARISON CHART

"The Most Mill For The Least Money"

Now you can make the same painstaking comparison that sold and satisfied leading plants on Greaves 2H plain and universal milling machines. A free chart cross-compares 22 significant specifications . . . including speeds, feeds, power and capacity . . . on each of the eight leading milling machines.

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Title_____

Firm_____

Address_____ City_____ Zone____ State_____

FORGINGS, Drop

Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow Bored

Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel

Bethlehem Steel Co., Bethlehem, Pa.
Cameron Iron Works, Inc., 1000 Silber Rd., Houston, Texas.
Morgan Engrg. Co., Alliance, Ohio.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Upset

Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING AND BENDING MACHINES

American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

FORMING AND STAMPING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FORMING TOOLS or Tool Blanks

Brown & Sharpe Mfg. Co., Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FRAMES, Machinery Welded

Mahon, R. H. Co., Detroit 34, Mich.

FURNACES, Heat-Treating

General Electric Co., Schenectady 5, N. Y.

FURNITURE, Shop

Standard Pressed Steel Co., Jenkintown, Pa.
Western Tool & Mfg. Co., 1640 E. Wheeler St., Springfield, Ohio.

GAGE BLOCKS

Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

GAGES, Air

Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Comparator

Alina Corp., 401 Broadway, New York 13, N. Y.
Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Ames, B. C., Co., Waltham 54, Mass.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St. New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth

Ames, B. C., Co., (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.

(*Continued on page 366*)

Checks Dimensions to HALF-MILLIONTHS!

THE HALF-MILLIONTHS MICRO-AC Electronic Microcomparator is for gage room use and ultra-precision production gaging. It reads .0000005" or .000001" per scale division, either side of center zero—on continuous linear scales, used interchangeably at will. Other sensitivities can be provided for the less-sensitive scale to meet specific requirements.

Frictionless gage-head movement and drift-free amplifier assure *consistent repeat readings.* Other features include fast meter response; easy-to-read scales (half-millionths divisions are 1/10" apart); low contact pressure; and quick set-up.

OTHER CLEVELAND GAGES with the same basic advantages are the PAR-AC Electronic Production Gage and INDI-AC Electronic Indicator. These permit *recording the readings.* The gage heads are often used with *special fixtures,* and for automatic gaging.

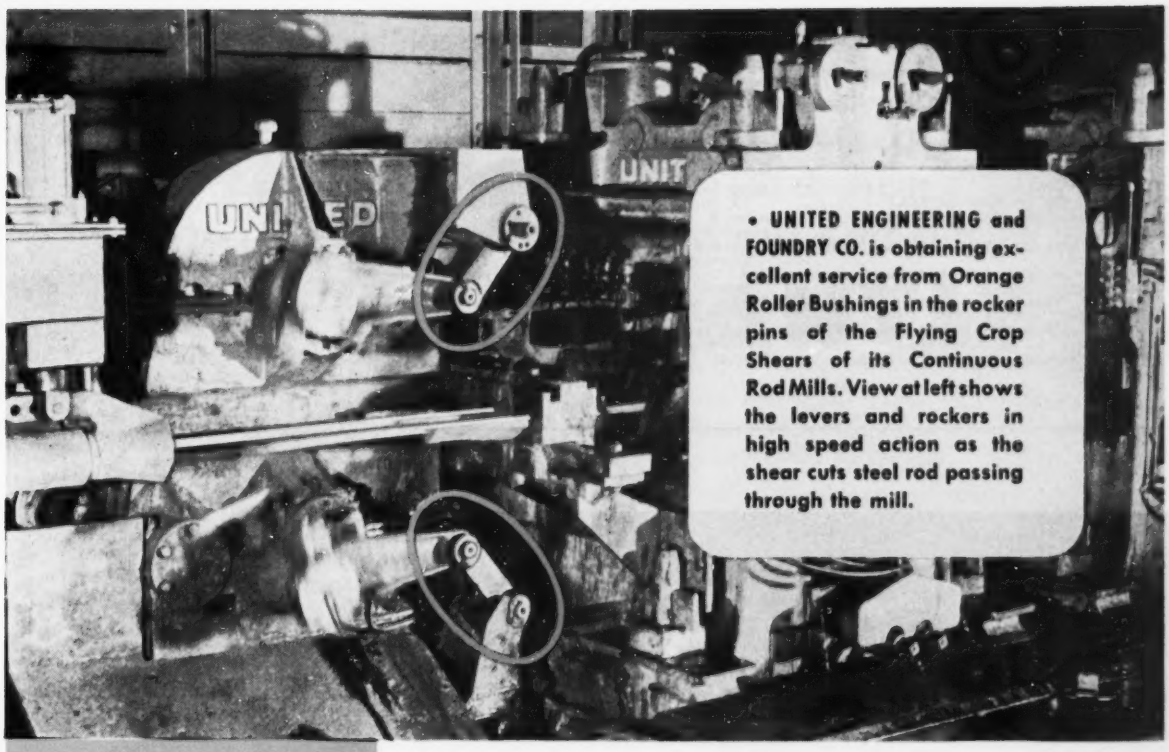
WANT DETAILS? Write for illustrated bulletins.

*BEST? Ask those who USE them. Names on request.

Designed, developed and manufactured by

Cleveland INSTRUMENT CO.
735-2 CARNEGIE AVE. CLEVELAND 15, OHIO

For more information on products advertised, use Inquiry Card, page 247

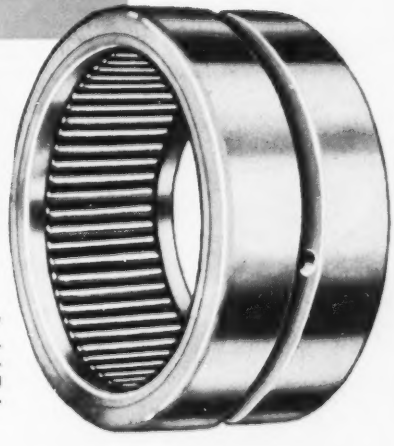


• UNITED ENGINEERING and FOUNDRY CO. is obtaining excellent service from Orange Roller Bushings in the rocker pins of the Flying Crop Shears of its Continuous Rod Mills. View at left shows the levers and rockers in high speed action as the shear cuts steel rod passing through the mill.

ORANGE ROLLER BUSHINGS

meet tough service requirements

Provide high capacity—require little space —stop friction and wear on shafts, parts, pins, etc.



Available in stock sizes from ½" to 8" shaft dia., fully interchangeable with all standard heavy-duty needle bearings. Stocked and serviced in all principal industrial areas.

Give your equipment longer life—less trouble—smoother, quieter operation by installing Orange Roller Bushings at all critical wear spots. These heavy-duty, precision needle bearings are performing with great success in all types of installations, under every operating condition . . . heavy loads, repetitive shock, 24-hour running, stop-and-go running, severe stresses, precision running.

Exacting control of roller uniformity by electronic gauging permits closer roller clearances, minimizes possibility of misaligned rollers while running. Wherever your designs call for needle bearings—specify Orange Roller Bushings to get the greatest combination of economy, capacity, compactness and trouble-free operation for your installation.

See your bearing supplier—or write us for Engineering Data Book

ORANGE ROLLER BEARING CO., INC., 552 Main Street, Orange, N. J.

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Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Dial

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Electric

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GAGES, Height

Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaine, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Plug, Ring and Snap

Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros. Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GAGES, Surface

Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Taper

Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Iroquois Corp., RFD 4 Box 331, 1800 E. 11 Mile Rd., Royal Oak, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GASKETS

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.

GEAR BLANKS, Non-Metallic

Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
General Electric Co., Schenectady 5, N. Y.

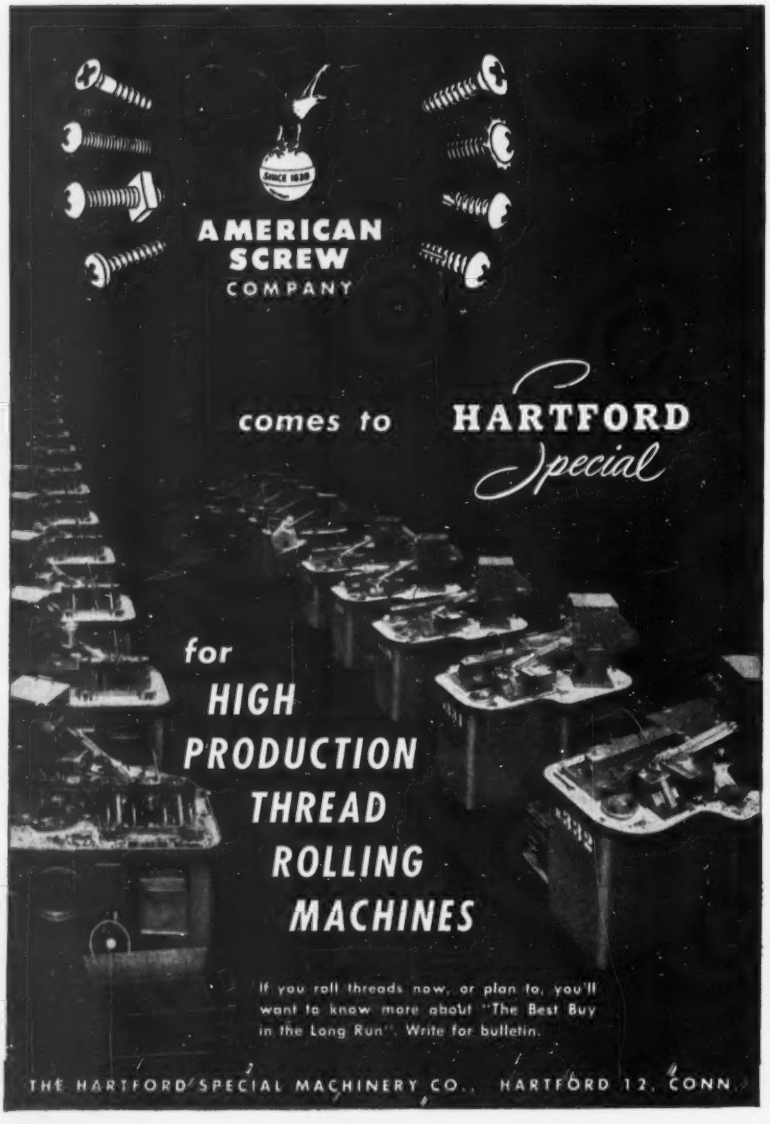
GEAR BURNISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.

(*Continued on page* 368)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THE HARTFORD SPECIAL MACHINERY CO., HARTFORD 12, CONN.

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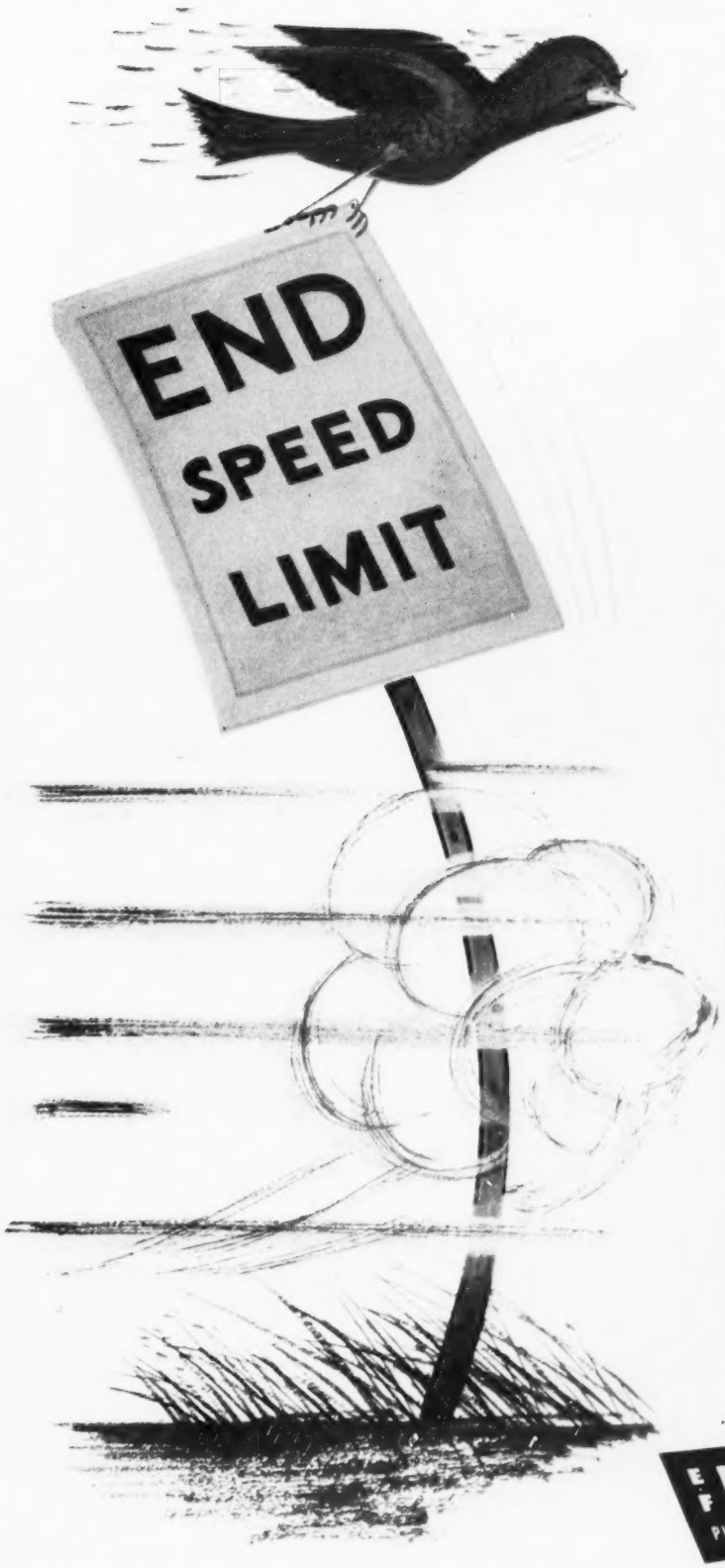

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So is Antisep . . . the heavy-duty water-soluble base that lubricates better and takes heat away faster than any cutting oil you can match against it. It has excellent anti-welding properties as well—and no objectionable odor.

Take the speed limit off your machines by using Antisep. Call the Houghton Man . . . or write to E. F. Houghton & Co., 303 W. Lehigh Avenue, Philadelphia 33, Pa. . . . for a trial production run.

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An Ohio manufacturer increased production substantially by changing to Antisep, machining collets of Hy-Ten steel (M temper) at 85 SFM—which was considerably higher than the speed he formerly regarded as top—and obtained improved finish as well.

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Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 Universty Ave., Rochester 3, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 Unversity Ave., Rochester 3, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Waltham Machine Works, Newton St., Waltham, Mass.

GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt. (Straight and Hourglass Types).
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., Springfield, Mass.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 Rover St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR MOTORS

See Speed Reducers.

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

(*Continued on page 370*)

Hit a new high in GEAR DEBURRING EFFICIENCY on a TWO-STATION UNIVERSAL Burr-Master

BME-24 two-station universal Burr-Master deburrs and chamfers both spur and helical gears as well as straight and involute form external splines.

Maximum operator utilization is yours with the BME-24 two-station universal Burr-Master for high production gear deburring and chamfering of spur and helical gears as well as straight and involute form splines.

Both stations can be tooled identically to handle the same gear, they can perform two different operations on the same part, or operate completely independently, turning out large volumes of two entirely different gears. Only one operator is required with any of these setups. At each station you can chamfer the entire tooth form and root at the rate of 5 teeth per second.

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14 BALL BEARINGS IN EIMCO'S NEW UNIDRIVE— ALL NEW DEPARTURES!

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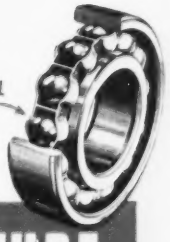

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KANNAPOLIS, N. C.	P. O. Box 1086	2-3181	**CLEVELAND**	3113 W. 110th St.	Winston 1-5454	**ST. LOUIS**	3001 Washington Blvd.	Franklin 6533
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National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Franke Gear Works, Inc., 1924 W. Columbia Ave., Chicago 26, Ill.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Ohio Gear Co., 1333 E. 179th St., Cleveland.
Perkins Machine & Gear Co., West Springfield, Mass.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GEARS, Rawhide and Non-Metallic

Amgears, Inc., 6633 W. 65th St., Chicago 38. Ill.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Beldon Ave., Syracuse, N. Y.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ohio Gear Co., 1333 E. 179th St., Cleveland.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

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General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

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Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.

GRINDERS, Carbide Tool

See Grinding Mches, Carbide Tool

GRINDERS, Centerless

Van Norman Co., Springfield, Mass.

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N. Y.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Thor Power Tool Co., Aurora, Ill.

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Conn.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
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(Continued on page 372)

With new heavy duty

Tap King tapping attachments

Whether you're tapping in 1½" steel plate, threading ¾" pipe, tapping "blind" in steel castings or open tapping in high carbon forgings—you'll be amazed at the "handling ease" of this heavy duty tapping attachment. Large capacity, greater thread accuracy, ruggedness and easy finger tip control are an unbeatable combination of features found only in the Tap King! The secret is in the heart of the unit which includes: an improved highly sensitive friction clutch; a new helical gearing mechanism, ball and needle bearings and the exclusive 17 tooth spline drive from clutch to tap holder gives a smooth, powerful drive with less strain, wear and vibration. These are only a few of the many features found in the TAP KING. Find out more about this "production" marvel, see how it can increase your production, save on tap breakage and parts spoilage, and give you an accuracy and uniformity on large hole operations that you're not getting now.

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Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Millers Falls Co., Greenfield, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Thor Power Tool Co., Aurora, Ill.

GRINDING FIXTURES

Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

Besley-Welles Corp., Beloit, Wis.
Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

GRINDING MACHINES, Broach

Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

GRINDING MACHINES, Camshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Carbide Tool

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GRINDING MACHINES, Centerless

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Chucking

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

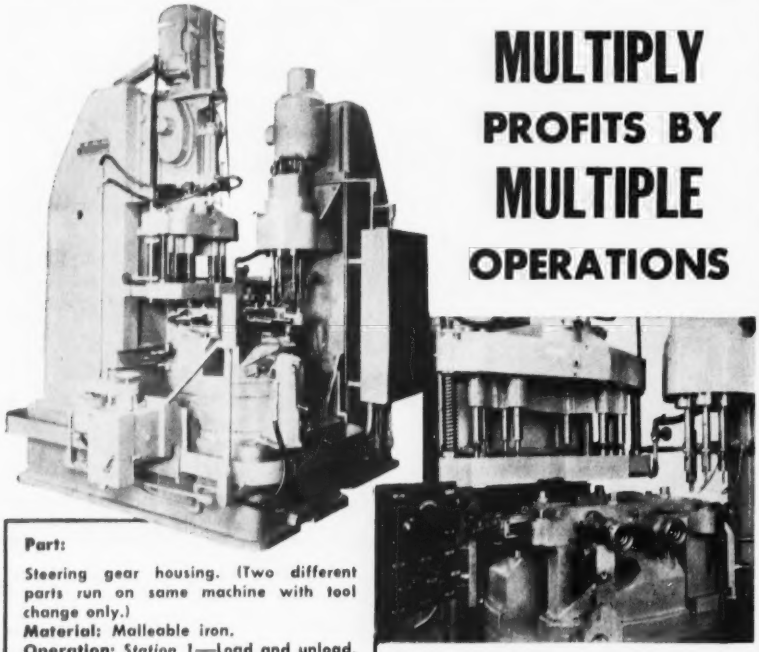
GRINDER MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Machine Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Besley-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Kindt-Collins Co., 12653 Elmwood Ave., Cleveland 11, Ohio.
Mattison Machine Works, Rockford, Ill.

(*Continued on page* 374)



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Part:

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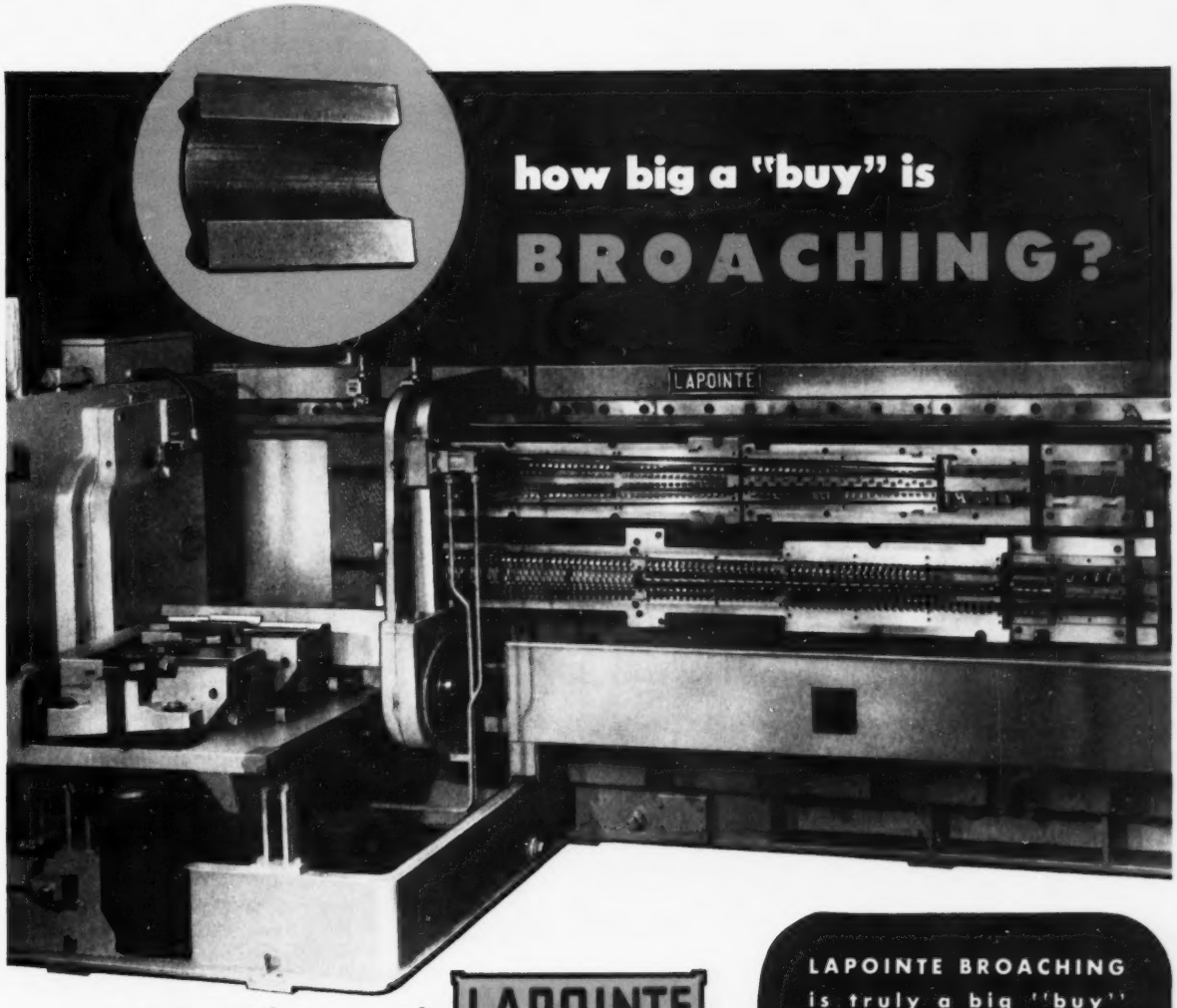
Material: Malleable iron.
Operation: *Station* 1—Load and unload. *Station* 2—Drill (3) .368" holes; (1) .120" hole. *Station* 3—Combination spot face and chamfer (3) holes, drill (1) 23/32" hole for tapping. *Station* 4—Tap (3) 7/16"-14 NC-3 thread; tap 1/2"-14 NPSF thread.
Description: Millholland 4-station automatic index machine equipped with 4-station automatic index table, with 1 No. 5 Millholland Automatic Unit driven by 7-1/2 HP motor with 8-spindle ball bearing multiple head for drilling 5 holes and combination spot facing and chamfering 3 holes; 4-spindle tapper on right-hand column.
Operator loads part and pushes button initiating automatic cycle, unloads. Two parts machined at a time.

MILLHOLLAND ENGINEERED FOR MAXIMUM PRODUCTION

For special production machines, Millholland Automatic Units offer distinct advantages. These self-contained units, driven by individual motors, are readily adapted to a wide range of operations. Their full automatic cycle with interlocked controls permits several units to be grouped for simultaneous operations, or they can be mounted on other production machines and synchronized to perform additional operations. Millholland Automatic Units have proved themselves in 30 years of outstanding performance on all types of jobs. Get full details in Bulletin M-5.

W. K. MILLHOLLAND MACHINERY CO.
6402 Westfield Blvd., Indianapolis 2, Indiana

For more information on products advertised, use Inquiry Card, page 247



a neat question . . . and LAPOINTE comes up with a neat answer in this amazingly smooth-operating

50 hp 120-inch stroke single ram horizontal BROACHING MACHINE with ELECTRO-MECHANICAL DRIVE

LAPOINTE BROACHING is truly a big "buy" in these days which require the utmost in production speed, the maximum ability to meet tolerance and finish specifications, and the lowest possible production costs.

Full **CARBIDE-TIPPED TOOLING** and a broaching speed up to **160 feet per minute** result in a production of 125 clusters per hour (625 individual bearing caps) completely broached in the same stroke as follows:

1st station: broach back face and boss. 2nd station: finish broach joint faces, edges, and adjacent chamfers.

Send for new bulletins on Lapointe electro-mechanical drive broaching machines:

Single ram horizontal, **SRHE-1**

Double ram vertical, **DRVE-1**

THE LAPOINTE MACHINE TOOL COMPANY
HUDSON, MASSACHUSETTS • U. S. A.
In England: Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

GRINDING MACHINES, Drill

Blake, Edward Co., 442 Cherry St., West Newton 65, Mass.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gailmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, Face

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besly-Welles Corp., Beloit, Wis.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment

GRINDING MACHINES, Gap

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

See Gear Grinding Machines

GRINDING MACHINES For Sharpening Cutters, Reamers, Hobs, Etc.

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gailmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, For Sharpening Turning and Planing Tools

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

GRINDING MACHINES, Internal

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, 32, Mich.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

GRINDING MACHINES, Jig

Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING MACHINES, Knife and Shear Blade

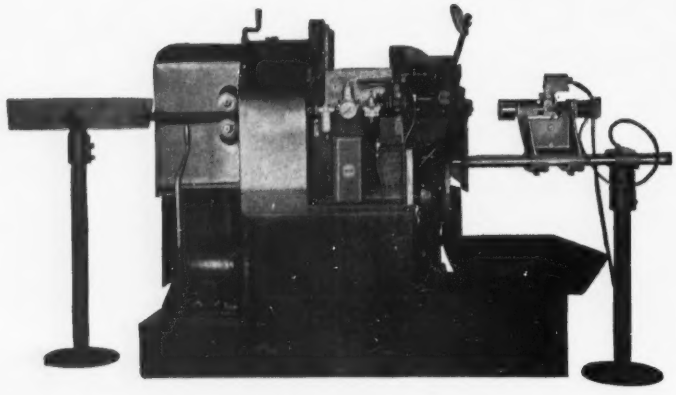
Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2,
Mattison Machine Works, Rockford, Ill.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

GRINDING MACHINES, Piston Ring

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

(Continued on page 376)

The NEW MODERN AUTOMATIC
CUTTING-OFF MACHINE



Cuts Off Tubing, Pipe and Shafting . . . FAST

Cuts off longer pieces than a regular automatic machine. In fact, cuts off *any length you want*—and cuts it *faster*. If your production *requires* quantity cutting-off of tubing, pipe or shafting, check the figures below against your present time.

1/2" Tubing

This machine cuts off and chamfers both outside edges of ½" .030 wall tubing, 5" long, at the rate of one every 2.5 seconds.

1 1/4" Cold Rolled

This machine cuts off and chamfers both ends of 1¼" cold rolled, 20" long, at the rate of one every 20 seconds.

1" Tubing

This machine cuts off and chamfers both outside edges of 3" long, at the rate of one every 3 seconds.

These popular, time saving machines are now available in four sizes, handling work up to 6¾" O.D. Their many cost cutting features are described and illustrated in our latest catalog that will be mailed promptly on request.

4" Threaded Studs

Cut and chamfered at one time—in 8 seconds—from 10 ft. length of stock already threaded. (¾" U. S. Standard.) Clean cut. Clean chamfer. Nuts start easily, with no extra finishing required.

WRITE FOR ILLUSTRATED CATALOG.

MODERN MACHINE TOOL CO.
Jackson, Michigan

For more information on products advertised, use Inquiry Card, page 247

Caterpillar

REG. U.S. PAT. OFF.

. . . in one time-cycle . . . on a single machine . . . and faster

JOB FACTS:

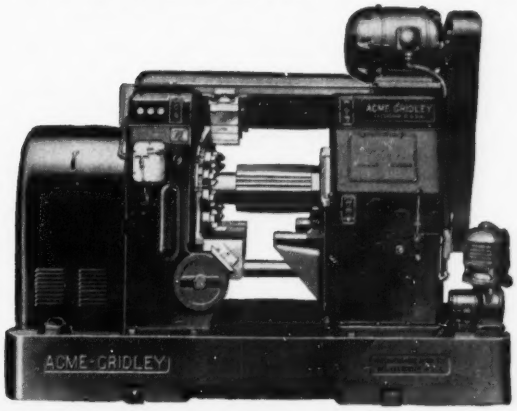
PART—Track Roller Bushing
SIZE—4½" diam. x 2¾" long
MATERIAL—Cast Iron
OPERATIONS—22, Carbide Tooling
MACHINE TIME FOR ALL OPERATIONS—43 seconds, 83 pieces per hour

CATERPILLAR Tractor Company is the world's largest producer of crawler type tractors. As they grow bigger each year, they specify larger heavier, more costly automatic machines—in this case a 20-ton, 8-spindle hydraulic chucker, for repeated runs on the part illustrated as well as others.

A fair question to ask is "Why the investment, why not do the job the single spindle way, or on 4-spindle automatics—why use 8-spindles?"

Plainly because they know the value of man-hours and floor space—have long since proved through comparison of actual cold cost production figures that the lowest machining costs yet possible are obtained by 2-at-a-time planning with

ACME-GRIDLEY 8-SPINDLE AUTOMATIC CHUCKING MACHINES



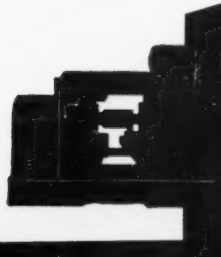
8 SPINDLE 8" ACME-GRIDLEY CHUCKER—
built also in 4 and 6 spindle models and in sizes 5¼" to 12"

Here's how they do it...

• the advantages are basically 3...and they interlock—

1. **MORE SPINDLES**—with double index to finish both ends of the piece at the same time—more tools with one machine, one operator and in a cycle time that is always controlled.
2. **BROADER BASE**—adaptability to similar jobs—through interchangeability of tools, attachments, cams and gears—reducing the change-over costs and inventory.
3. **EXPERIENCE AT SOURCE**—Caterpillar knows that Acme-Gridley basic design, stamina and tool engineering to solve new problems are dependable—never let you down.

This is just another example among thousands based on our 55 years since we produced the first "multiple." Maybe your chucking problems are simpler, which makes it easier for you and for us. Why not find out, anyway?



The NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

ACME-GRIDLEY BAR and CHUCKING AUTOMATICS

1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • Limit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing

GRINDING MACHINES, Profile

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cleveland Grinding Machine Co., 1643 Eddy Rd., Cleveland 12, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cello-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Kindt-Collins Co., 12653 Elmwood Ave., Cleveland 11, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Ring Wheel Ball Race, Etc.

Besly-Welles Corp., Beloit, Wis.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Radial

Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Radius, Link

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Farrel-Birmingham Co., 25 Main St., Ansonia Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Surface

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besly-Welles Corp., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Gollmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Thor Power Tool Co., Aurora, Ill.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING MACHINES, Thread

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Worm

Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING WHEELS

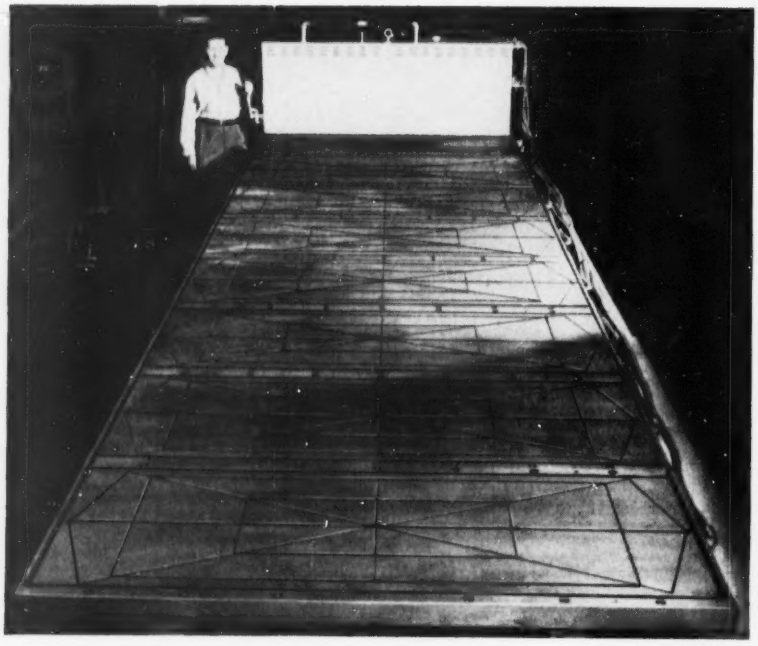
Allison Co., Bridgeport, Conn.
Besly-Welles Corp., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cincinnati Milling Machine Co., Grinding Wheels Div., Cincinnati Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.

GROOVE PINS

Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

(Continued on page 378)

Walker Does It Again-



Walker, pioneer in the chuck industry, has been utilizing magnetic force to make all types of special and standard chucks since 1887.

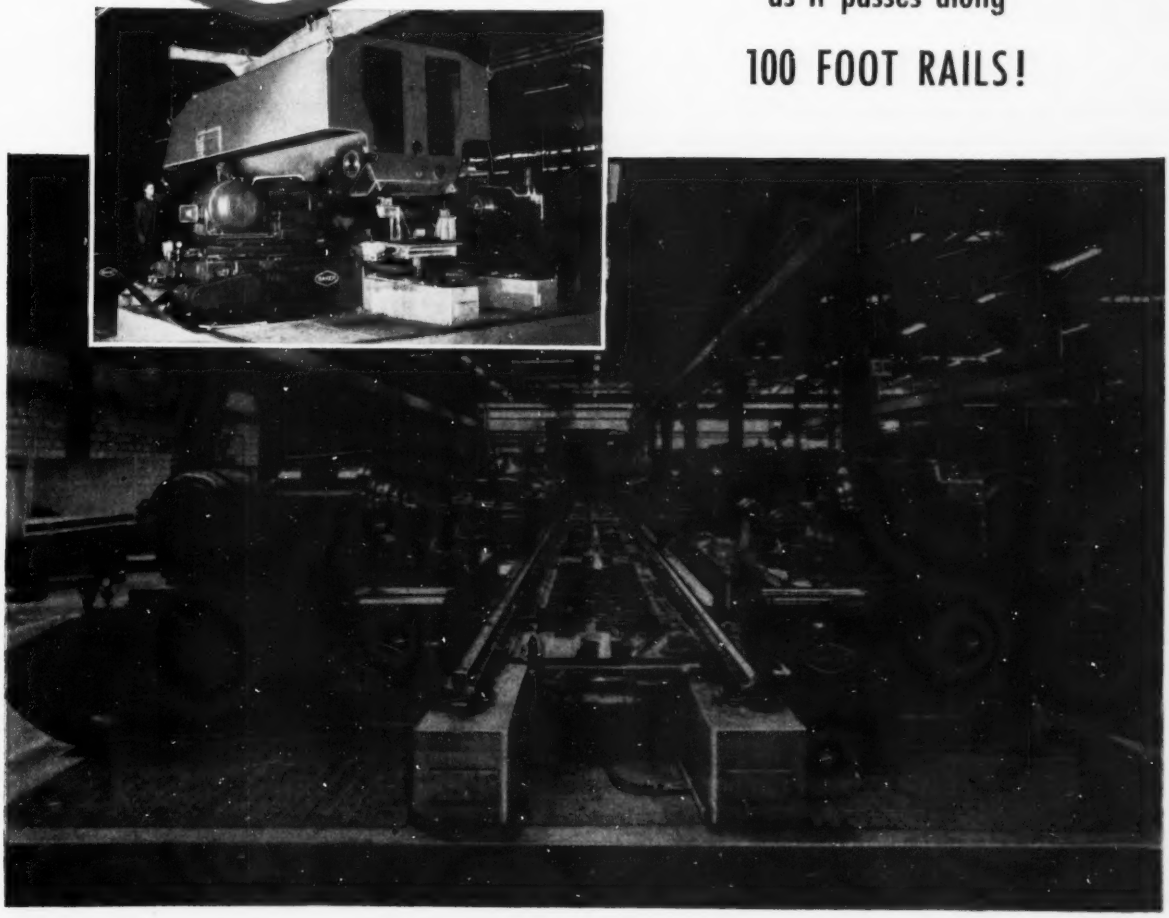
Walker now harnesses atmospheric force for special vacuum chucks to hold non-magnetic materials. First a leader in magnetic force—now a pioneer in atmospheric force.

Hold Everything with Walker Chucks

O. S. WALKER CO. Inc.
WORCESTER 6, MASSACHUSETTS
Original Designers and Builders of Magnetic Chucks

For more information on products advertised, use Inquiry Card, page 247

New BAKER Automatic MACHINES 15,000 lb. TANK HULL as it passes along 100 FOOT RAILS!



OPERATIONS: DRILLING . . . TAPPING . . . BORING . . . FACING on 102 holes . . .

10 main bores Mounted on a specially-built floating concrete slab, this huge new Automatic Baker Transfer Machine accurately performs multiple drilling, tapping, boring and facing operations on 15,000 pound rough weldments 9 feet wide and 16 feet long. Savings achieved in production costs with a machine of this type are tremendous. Baker engineering know-how stands ready to solve your production problems . . . with cost cutting standard or special, single or multi-operation machines.

Write regarding your specific job problems . . .

BAKER BROTHERS, INC. Toledo, Ohio
DRILLING...TAPPING...KEYSEATING and CONTOUR GRINDING MACHINES

GROOVING TOOLS, Internal
Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

HAMMERS, Drop
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Morgan Engrg. Co., Alliance, Ohio.

HAMMERS, Forging Air
Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 200 "G" St., Wilmington 99, Del.

HAMMERS, Pneumatic
Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

HAMMERS, Portable Electric
Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Millers Falls Co., Greenfield, Mass.

HAMMERS, Power
Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.

HAMMERS, Shaft
S K F Industries, Inc., P.O. Box 6731, North Philadelphia, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

HAMMERS, Soft
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HARDENING EQUIPMENT
Gleason Works, 1000 University Ave., Rochester, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

HARDENING MACHINES, Flame
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Gleason Works, 1000 University Ave., Rochester, N. Y.

HARDENING, Surface Treatment
Electrolizing Corp., 1505 East End Ave., Chicago Heights, Ill.

HARDNESS TESTING INSTRUMENTS
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shore Instrument & Mfg. Co., Van Wyck Ave. and Carll St., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HEADING MACHINES
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

HOBBING MACHINES
See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

HOBS
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Union Twist Drill Co., Athol, Mass.

HOIST HOOKS
Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HOISTING AND CONVEYING EQUIPMENT
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

HOISTS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

HOISTS, Chain, Etc.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

HOISTS, Electric
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

(*Continued on page* 380)

Get Hep to FRICTION SAWING with Tannewitz HIGH SPEED BAND SAWS

IT'S THE FASTEST, MOST ECONOMICAL MEANS OF CUTTING METAL AND MANY OTHER MATERIALS

There's a revelation in store for you if you have never tried friction sawing with these machines. Flat sheets of either soft or hardened steels, non-ferrous materials can be sawn in a fraction of the time required by other methods. Cutting armor plate and other materials is not impractical, and for cutting formed parts there's nothing that compares with it. Cuts are smooth and down-drag of saw is so minor that no rest of any kind is needed. Write for your free copy of "FRICTION SAWING". Now!

For trimming castings of all types of metals our variable speed band saws are real production expediters. Write for bulletin.

GL-6-1729

SAWING MACHINERY SPECIALISTS

THE TANNEWITZ WORKS
GRAND RAPIDS, MICHIGAN

For more information on products advertised, use Inquiry Card, page 247

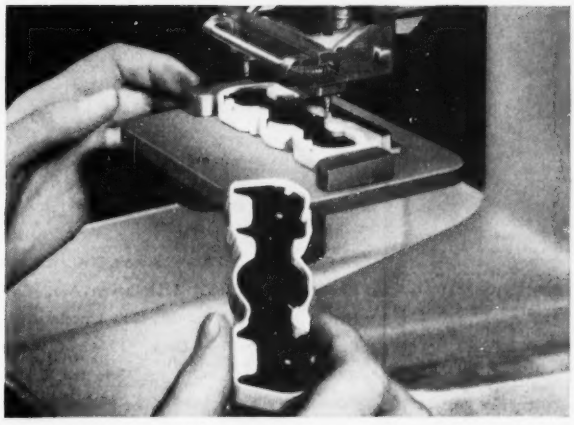
Why stop AUTOMATION at Assembly?

. . . give millions of assembly hands a head start

Progress toward automation* does not end where assembly begins for manufacturers who take full advantage of the P-K Fastening Method. They *eliminate* manual operations like tapping, nut-running, inserts in plastic — and avoid the attendant trouble and expense. Automatic screw driving equipment can be used to further mechanize hand operations on many applications. Assembly savings run up to 50% and more.

Complete automation is, for most, a *distant* dream. Meanwhile, assembly *hands* control your fastening costs. Find out how P-K Self-tapping Screws can *double — even triple* — their efficiency. It *pays* — and pays well — *today.* Talk to a P-K Assembly Engineer. Parker-Kalon Division, General American Transportation Corporation, 202 Varick St., New York 14.

**Successive elimination of manual operations*

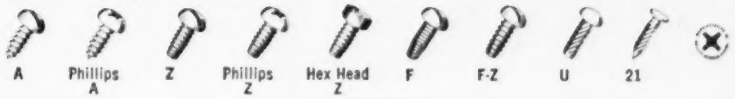


AUTOMATIC DRIVING adds *extra* speed to the faster P-K Fastening Method. Here, an automatic, double-spindle, hopper-fed machine is being used for driving two P-K Type U Drive Screws simultaneously in a plastic electric outlet. Single or multiple spindle machines are available from several manufacturers.

MAYTAG ASSEMBLY MOVES FASTER because fastenings made with P-K Self-tapping Screws are simpler, easier, dependably secure. In the Maytag Dryer shown, 80 Type A and 46 Hex Head Type Z are used, in all, for fastening sheets from 24 to 11 gage — driven with air-operated tools.

PARKER-KALON®

The Original SELF-TAPPING SCREWS



IN STOCK see your nearby P-K Distributor

HONING MACHINES, External

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

HONING MACHINES, Internal (Cylinder)

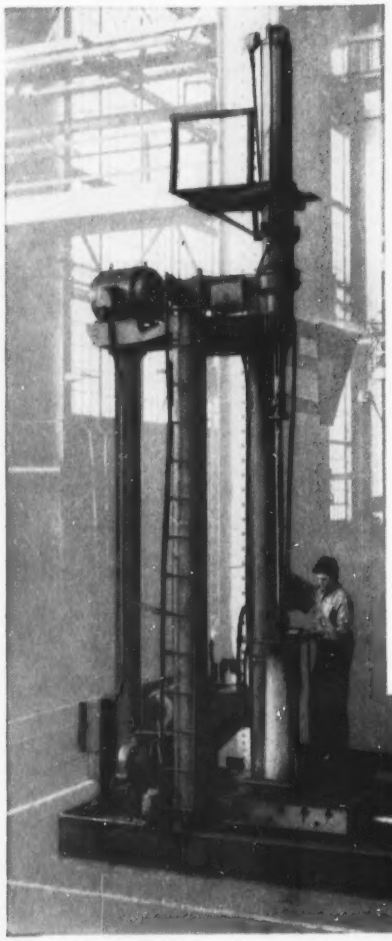
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co. 102 20th St., Moline, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HONING STONES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Moline Tool Co., 102 20th St., Moline, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sunnen Products Co. (Internal & External), 7900 Manchester Ave., St. Louis 17, Mo.

HONING TOOLS AND FIXTURES

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.



CUT AWAY FERROUS & NON-FERROUS METALS QUICKLY AND CHEAPLY WITH

FULMER HONING MACHINES

hone as much as 1/16 inch of material at 1-1/2 to 2 cu. inch per minute

Cut away material to tolerances as close as .0001 (±) on size, straightness and roundness.

Generate true INTERNAL BORES up to 40" diameter.

Photo taken in very large steel mill.

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WRITE for personal copy of our honing bulletin.

CHIPS RUN AS LARGE AS SIX INCHES

Stock is cut away quickly, saving time and costs. Even a "novice" can learn to do this on a FULMER in a few hours.

C. ALLEN FULMER CO.

1231 First National Bank Bldg. Cincinnati 2, Ohio

HOSE, Leather, Rubber, Metallic, Etc.

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.

HYDRAULIC MACHINERY Tools and equipment

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4 Wis.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.

HYDRAULIC POWER UNITS OR TOOL HEADS

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Barnes W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Turchon Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

INDEXING AND SPACING EQUIPMENT

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

(*Continued on page* 382)

For more information on products advertised, use Inquiry Card, page 247

LARGEST SELECTION OF SWISS HIGH-PRECISION MACHINE TOOLS IN THE UNITED STATES

Carl Hirschmann Company, Inc., stocks spare parts and accessories for all its lines and makes them readily available from all Hirschmann Branches. It backs these lines here with skilled technicians, factory services, and American guarantees comparable to those obtained on domestic tools.

A typical SWISS high-precision machine tool sold and serviced by HIRSCHMANN. Hauser Type 5 Jig Borer. The ultimate in precision and quality.

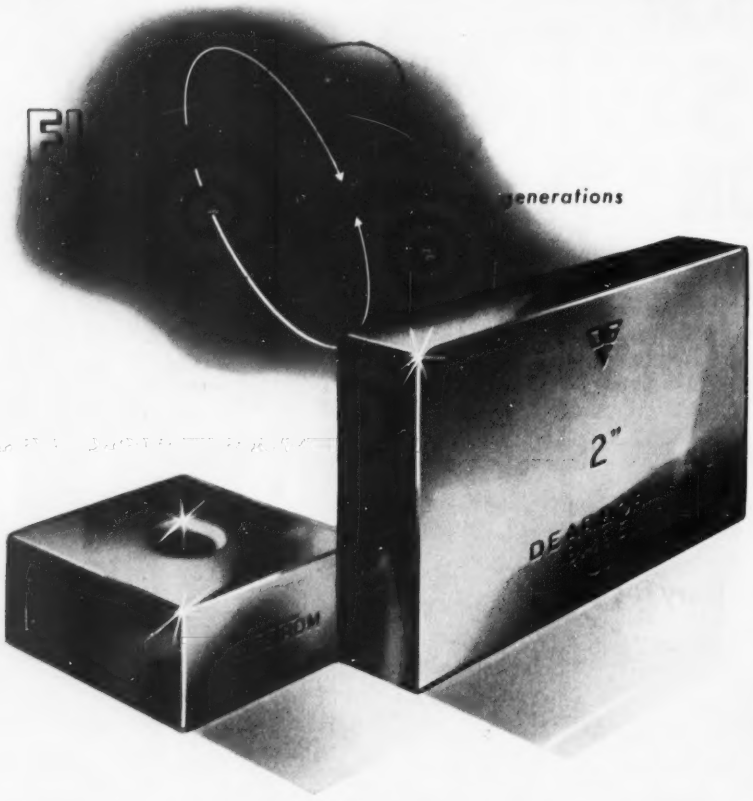
CONDENSED SUMMARY OF HIRSCHMANN BLUE RIBBON TOOLS

Backing-off Machines, Automatic . . . Borers, Jig . . . Burnishing Machines . . . Cam-making Equipment . . . Carbide Grinding and Lapping Machines . . . Checking Instruments, Optical . . . Chucks, Keyless Drill . . . Die Sinkers . . . Drilling Machines . . . Form Cutter Milling Machines, Automatic . . . Gear Hobbing Machines . . . Grinders, Jig . . . Grinders, Twist Drill . . . Grinding Machines, Automatic Cutter . . . Grinding Machines, Carbide . . . Grinding Machines, Horizontal Rotary Surface . . . Grinding Machines, Surface . . . Grinding Machines, Relieving Tool . . . Grinding Machines, Universal Cylindrical . . . Grinding Machines, Universal Tool . . . Lathes, Rapid Copying . . . Lathes, Repetition . . . Lathes, Toolmakers' . . . Lathes, Turret . . . Measuring Instruments, Micrometer . . . Measuring Instruments, Optical . . . Milling Machines, Horizontal . . . Milling Machines, Vertical, Pantograph . . . Milling Machines, Form Cutter, Automatic . . . Polishing Machines . . . Micrometers . . . Microscopes . . . Pinion Cutting Machine, Automatic . . . Presses, Bench . . . Presses, Heavy Duty . . . Presses, Horizontal, Rapid . . . Presses, Precision Blanking . . . Presses, Shaving . . . Projectors, Profile . . . Screw Machines, Automatic . . . Screw Machines, Swiss Automatic . . . Screw Machines, Woodscrew . . . Tables, Rotary, Rotary Tilting . . . Tapping Machines, Lead Screw . . . Tapping Machines, Double Friction Clutch . . . Thread Rolling Machines, Automatic . . . Turning Machines, Semi-Automatic . . . Watch Manufacturing Machines, Special Automatic . . . Wheel, Pinion & Segment Cutting Machines, Automatic.

Largest Selection of SWISS Precision Machine Tools in U.S.

HIRSCHMANN

CARL HIRSCHMANN COMPANY, INC., 30 Park Avenue, Manhasset, N. Y.
BRANCHES: CHICAGO, WATERBURY, DETROIT, LOS ANGELES, MILWAUKEE
REPRESENTATIVES IN PRINCIPAL CITIES

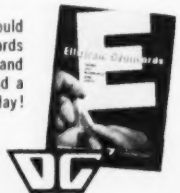


No finer GAGE BLOCKS at any price!

By any comparison you care to make . . . block-for-block, set for set . . . you'll find Ellstrom Chromium Plated Standards truly outstanding in the field of precision measurement. Materials used in their manufacture are precisely treated and thoroughly tested for coefficient of expansion, uniform hardness, and metallurgical stability. The durable chromium plated gaging surfaces are applied and finished by special Ellstrom methods which assure you of greater serviceability, longer wearing millionths. And flatness, parallelism, and specified accuracy of each individual block is fully certified by the most uncompromising final inspection found anywhere in the industry.

So next time you need gage blocks, specify Ellstrom Standards. Furnished in 28 basic sets, either square or rectangular styles, with block sizes in step series from .010" up to and including 20.000". Basic accessories also available . . . plus tungsten carbide wear blocks and individual blocks to meet your specific requirements.

IF YOU BUY GAGE BLOCKS, you should have this handy new Ellstrom Standards Catalog. Contains complete specifications and prices in convenient tabular form . . . and a copy is yours for the asking. Send for it today!



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Dearborn Gage Company • 22035 Beech Street • Dearborn, Mich.
Originators of Chromium Plated Gage Blocks

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INDICATORS, Dial
Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Speed
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Test
Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT
General Electric Co., Schenectady, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

INTENSIFIERS, Hydraulic
Baldwin-Lima-Hamilton Corp., Philadelphia 42.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

JACKS, Planer
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.

JIG BORER
See Boring Machines, Jig.

JIGS AND FIXTURES
Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Jahn, B., Manufacturing Co., Ellis St., New Britain, Conn.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

JOINTS
See Fittings, Hydraulic, Pneumatic, Etc.

KEYSEATERS
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Co., Rochester, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginow, Mich

(*Continued on page* 384)

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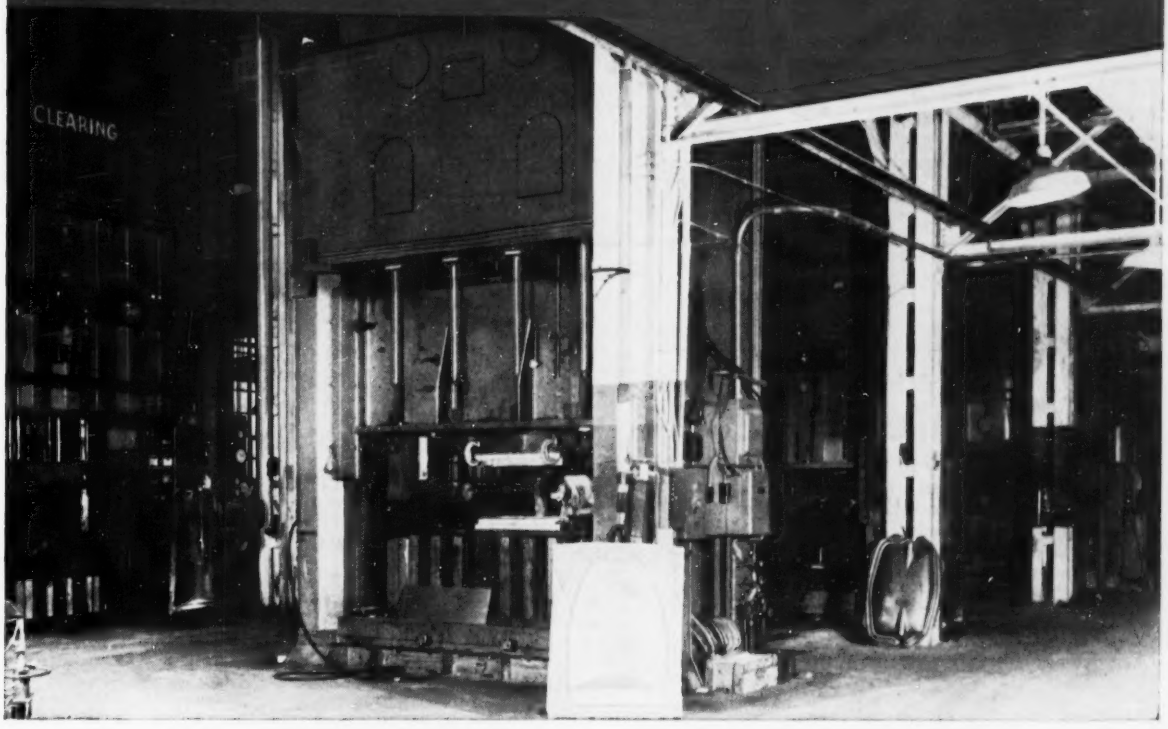
FOR PROTOTYPE PARTS . . .



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DIE-MADE SHEET METAL PARTS!

If you are following the example of a number of America's leading industries in building complete and accurate product prototypes before establishing definite manufacturing procedures, here is a time- and money-saving service which has become an important part of many such programs.

Take Allied draw and form dies for producing prototype parts . . . such dies are made of either plastic or Allite (zinc alloy) depending on the number or type of pieces required. Cost and delivery is considerably less than that of production dies, yet accuracy is comparable in every way. Upon completion of the dies, prototype stampings are produced in Allied's press equipment, then trimmed, flanged and pierced by hand.

These prototype parts are another of Allied's die and stamping services which result in a dollar savings to you. We would appreciate your inquiry, or better yet a personal visit to our Plant Four in Hillsdale, Michigan, to show you such operations.

Other Allied Products { SPECIAL COLD FORGED PARTS • STANDARD CAP SCREWS • HARDENED AND PRECISION GROUND PARTS • R-B INTERCHANGEABLE PUNCHES AND DIES

PRECISION • EXPERIENCE • DEPENDABILITY

ALLIED CORPORATION PRODUCTS

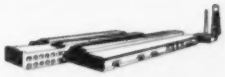
ALLIED PRODUCTS CORPORATION

DEPT. D-18 • 12619 BURT ROAD • DETROIT 23, MICH.

PLANT 1
Detroit, Mich.

PLANT 2
Detroit, Mich.

PLANT 3
Hillsdale, Mich.



PLANT 4
Hillsdale, Mich.

For more information on products advertised, use Inquiry Card, page 247

KNURL HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.

KNURLING TOOLS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LAPPING MACHINES
Barnes Drill Co. (Straight Line or Rotating), 814 Chestnut St., Rockford, Ill.
Cincinnati Grinders, Inc. (Centerless), Cincinnati, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LAPPING PLATES, Hand
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.

LATHE AND GRINDING DOGS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHE ATTACHMENTS
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

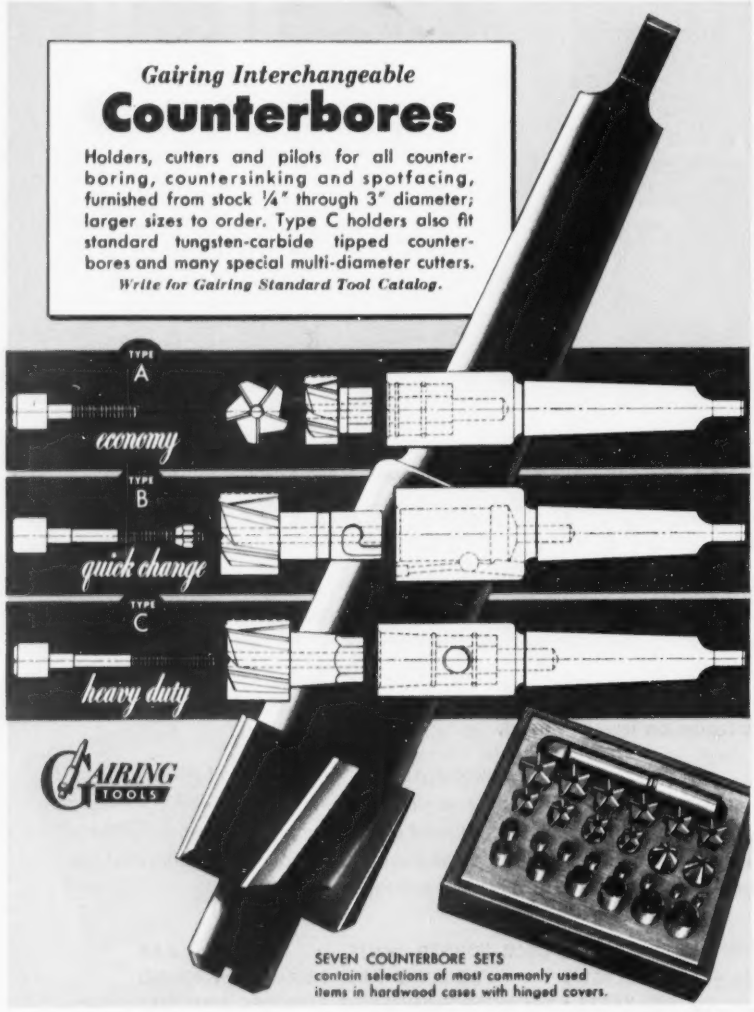
LATHE CONVERTER
Master Mfg. Co., Hutchinson, Kansas.

LATHES, Automatic
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bradgeport 2, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St. Sidney, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Porter-Cable Machine Co., Salina St., Syracuse, N. Y.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Axle
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls, Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

(*Continued on page* 386)


Gairing Interchangeable
Counterbores
Holders, cutters and pilots for all counterboring, countersinking and spotfacing, furnished from stock ¼" through 3" diameter; larger sizes to order. Type C holders also fit standard tungsten-carbide tipped counterbores and many special multi-diameter cutters.
Write for Gairing Standard Tool Catalog.
TYPE A
economy
TYPE B
quick change
TYPE C
heavy duty
GAIRING TOOLS
SEVEN COUNTERBORE SETS
contain selections of most commonly used items in hardwood cases with hinged covers.

Although we at GAIRING like to prove to you our ability to design and produce special production tooling, don't come to us for the tough jobs only • The counterbores shown here, with various holders, the standard back spotfacers and core drills, are real quality production tools made by us for 35 years. Better write us today for the GAIRING Standard Tool Catalog and Price List.

In Canada: A. C. Wickman (Canada) Ltd., Queensway, Toronto 14

The GAIRING Tool Company

21225 Hoover Road • Detroit 32, Michigan

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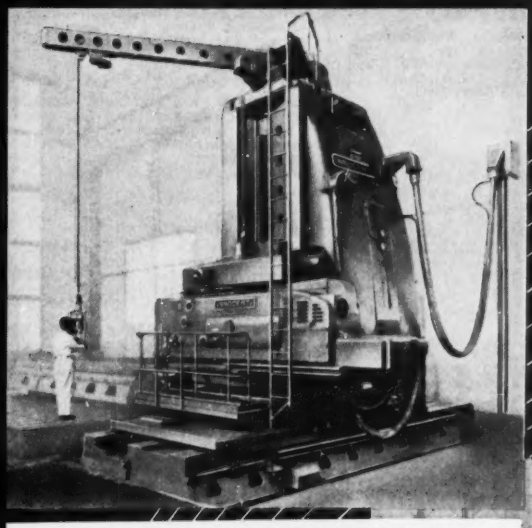

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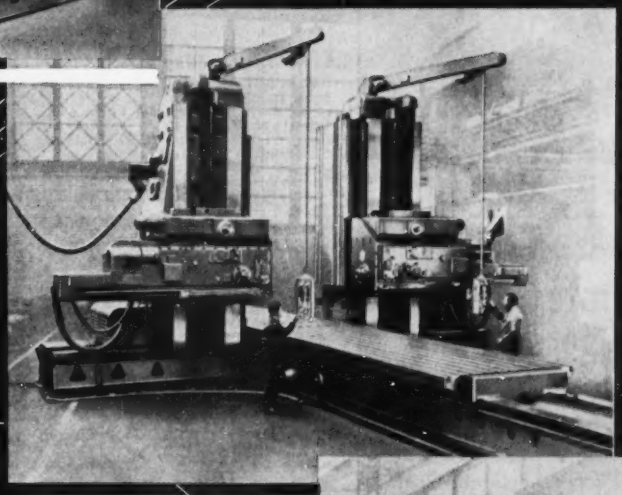

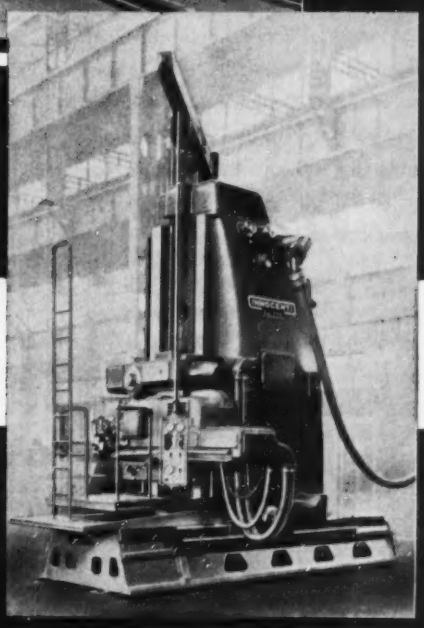

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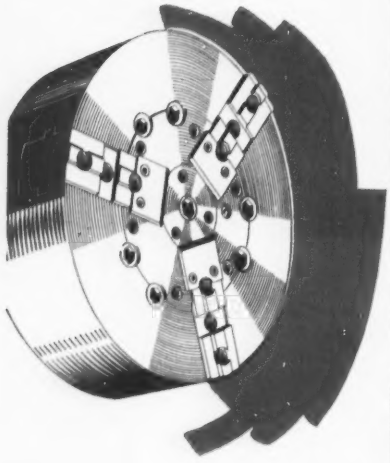
SOC. GENERALE PER L'INDUSTRIA METALLURGICA E MECCANICA
MILAN, Italy.

Information and literature from: Innocenti Corporation, 350 Fifth Avenue, New York 1, N. Y.

SKINNER
precision
POWER CHUCKS



accurate • fast
safe • dependable

"with power to push production"

Available from 6" to 24" with forged steel bodies, and with 2 or 3 adjustable, non-adjustable or serrated jaws. Double-acting rotating and non-rotating air cylinders available for all chuck sizes and for actuating all types of holding fixtures and tailstocks.

Write for catalog describing the complete line of Skinner power and manually operated chucks and accessories. Ask for movie "Chucks and Their Uses" for free showings.

THE CREST SKINNER CHUCKS OF QUALITY

THE SKINNER
CHUCK COMPANY
206 Edgewood Avenue, New Britain, Conn.

LATHES, Boring
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Crankshaft
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Duplicating
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Engine and Toolroom
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Logan Engrg. Co., 4901 W. Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Morey Machinery Co., Inc., 383 Lafayette St., New York, N. Y.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Corp., Sidney, Ohio.
Simmons Machine Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.

LATHES, Gap
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Co., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Gun
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Seneca Falls Mch. Co., Seneca Falls, N. Y.

LATHES, Hollow Spindle
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Manufacturing Type
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

LATHES, Spinning
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom
See Lathes, Engine and Toolroom.

LATHES, Turret
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morey Machinery Co., Inc., 383 Lafayette St., New York, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Potter & Johnston Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

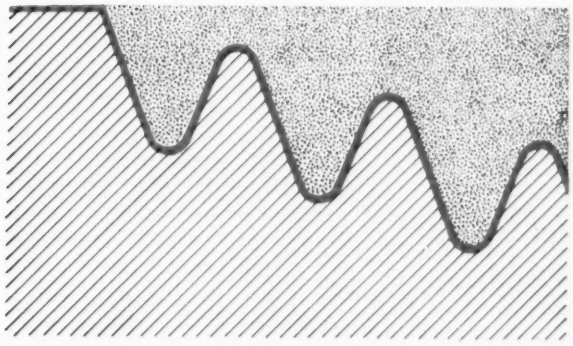
LATHES, Vertical Turret
American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

LAYOUT FLUID
Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

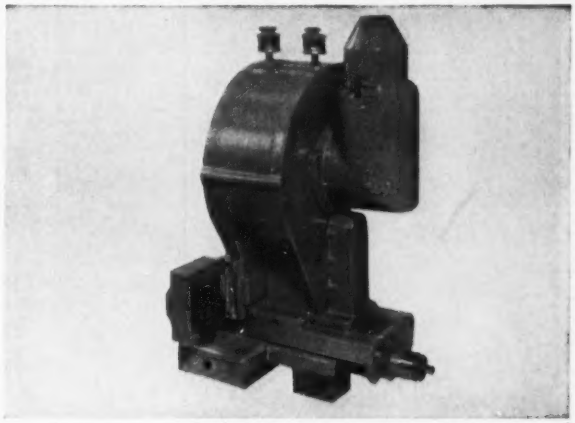
LEVELS
Bullard Co., Brewster St., Bridgeport 2, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

(*Continued on page* 388)

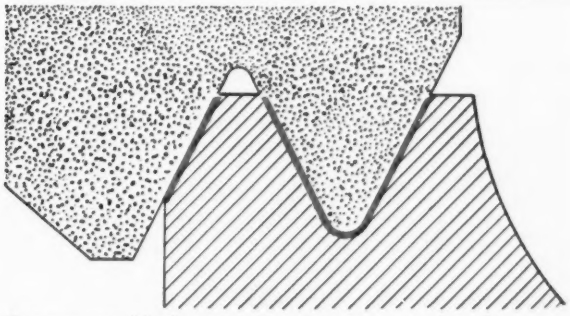
Key to Accurate, Fast Contour Grinding . . . A HOGLUND Automatic or Manual Dresser



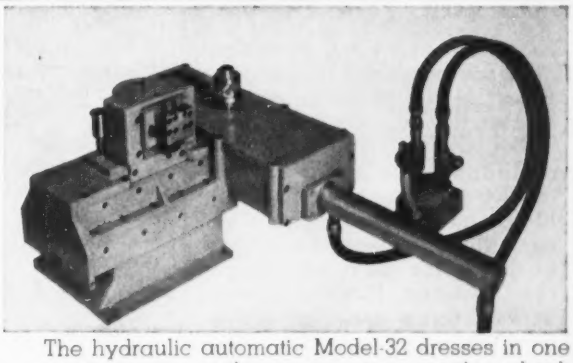
Pine-tree form at base of jet-engine bucket has a combination of convex and concave surfaces difficult to put into a grinding wheel—without the Hoglund Model-7B Dresser.



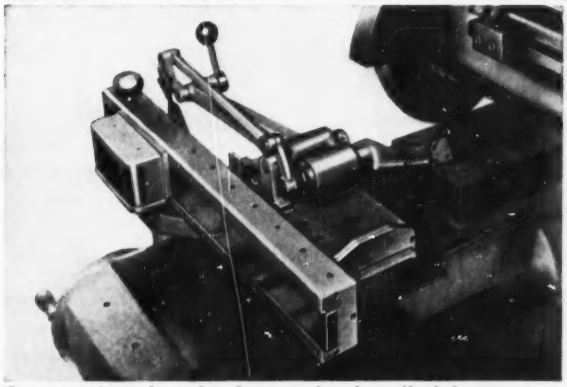
Automatic and electric-motor powered, the Moael 7-B eliminates all skill in dressing. Two circular cams move the diamond across and into the wheel, providing a very compact unit. It is being used on the Thompson double-wheel bucket and blade grinder.



Compressor-blade root form has extremely close tolerances. A Model-32 Hoglund Dresser mounted on a Thompson Surface Grinder provided the high degree of accuracy and perfect blending of radius and tangent needed.



The hydraulic automatic Model-32 dresses in one continuous, smooth movement across the wheel. Diamond movement is reduced from the magnified contour template by inclined planes—there is **no** pantagraph linkage.

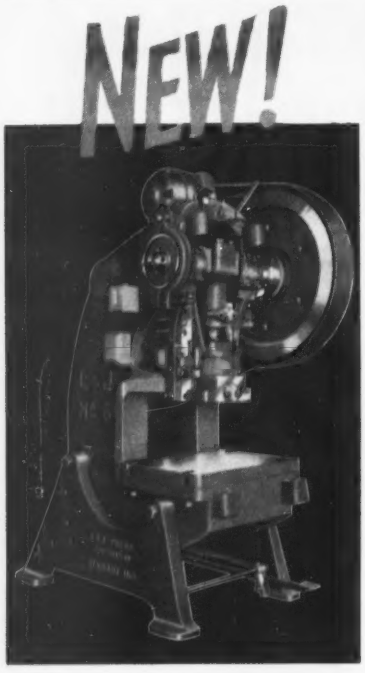


Three-inch-wide wheels can be handled by our newest model, the KB11-3 manual dresser. It will fit on any horizontal surface grinder—and will dress any contour, no matter how complex, that can be entered by the diamond.

We make over 40 models, both special and regular, for surface, cylindrical and gear grinding machines. They all share four common features: (1) Pantograph linkage eliminated, usually by inclined planes. (2) Wheel dressed in one continuous operation. (3) Compactness and light weight. (4) A microscope fixture for precise setting of the diamonds in their holders.

Send us your blueprints and have us submit our recommendations.

HOGLUND
ENGINEERING & MANUFACTURING CO.
Berkeley Heights New Jersey



65-ton L&J Press

Here's the new No. 6 press that gives you more value through features that insure efficiency and low production costs.

The heavy, rigid frame holds deflection to a minimum for greater accuracy and longer die life. Extra depth of throat adds versatility. Replaceable bronze bushings for main and upper ram bushings. Buttress threads on ram screw and replaceable hard bronze ball seat. Roller bearings in flywheel or main gear and backshaft mountings. Long, precision-scraped gibs maintain alignment and accuracy. Air clutch available. Also made in back-geared model.

SPECIFICATIONS

Strokes per minute	85
Ram stroke, standard	4"
Max. stroke (to order)	7"
Throat depth	13½"
Die space, standard*	13"
Special,* up to	19"

*bed to ram, stroke down, adjust. up

Contact our local distributor for complete information. Also, 16 other O.B.I. models—6 to 80 ton capacities. Or, write for literature.

L&J PRESS CORPORATION
1631 STERLING AVENUE
ELKHART, INDIANA

LOCKNUTS
Link-Belt Co. (For Positioning Bearings), 519 N. Holmes Ave., Indianapolis 6, Ind.

LUBRICANTS, Including Extreme Pressure (EP) Machinery Lubricants
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shear-Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

LUBRICATING SYSTEMS
Farvel Corp., 3249 E. 80th St., Cleveland, Ohio.
Madison-Kipp Corp., Madison, Wis.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

MACHINE KEYS
Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

MACHINE PARTS, Special
Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

MACHINISTS' SMALL TOOLS
See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MANDRELS
See Arbors and Mandrels.

MARKING MACHINES AND DEVICES
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit, Mich.

MASKS, Painting
Conforming Matrix Corp., 342 Toledo Factories Bldg., Toledo 2, Ohio.

MEASURING MACHINES AND INSTRUMENTS, Precision
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Crane Parking Co., 1800 Cuyler Ave., Chicago.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MEASURING WIRES, THREAD, SPLINE AND GEAR
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

METAL, Bearings
See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.

METERS
See Recording Instruments.

MICROMETERS
Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MICROSCOPES, Toolmakers
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING AND CENTERING MACHINES
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Automatic
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench
Barker Engrg. Co., 500 Green Rd., Cleveland 21, Ohio.
Hardinge Bros., Inc. (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Circular Continuous
Consolidated Machine Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Phialdelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

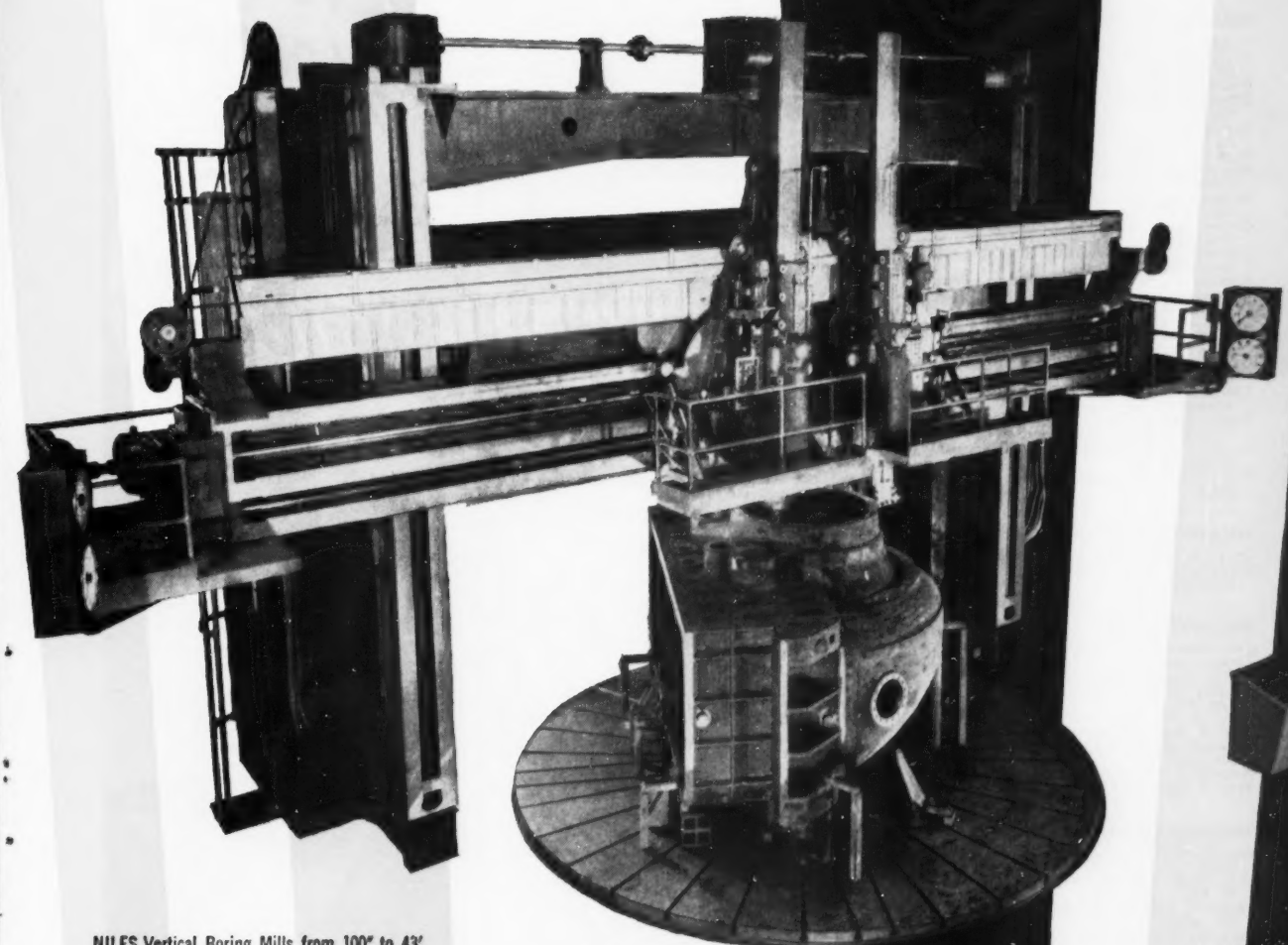
(*Continued on page* 390)

For more information on products advertised, use Inquiry Card, page 247

NILES

vertical mills
can do your
big jobs faster
and better

Write! We'll tell you how Niles tools can speed your big jobs at low cost.



NILES Vertical Boring Mills from 100" to 43' are built to take the pressures and stresses of fast, deep cutting carbide tools...they combine extra ruggedness with super fine precision.

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BALDWIN BLH LIMA-HAMILTON

HAMILTON DIVISION, HAMILTON, OHIO

MILLING MACHINES, Duplex
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand
Barker Engrg. Co., 500 Green Rd., Cleveland 21, Ohio.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain and Universal
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Fray Machine Tool Co., 151 W. Windsor Rd., Glendale 4, Calif.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st. St., Milwaukee 14, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Lincoln Type
Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Planer Type
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R. Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Profile
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal
Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Turret Type
Bridgeport Machines, Inc., Linley Ave., Bridgeport, Conn.

MILLING MACHINES, Vertical
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincninati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MODEL AND EXPERIMENTAL WORK
See Special Machinery and Tools.

MOLD AND DIE COPYING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

MOLDING MACHINES, Plastic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

MOTORS, Electric
Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Howell Electric Motor Co., Howell, Mich.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

MOTORS, Hydraulic
Gerotor May Corp., Oliver St. and Maryland Ave., Baltimore, Md.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

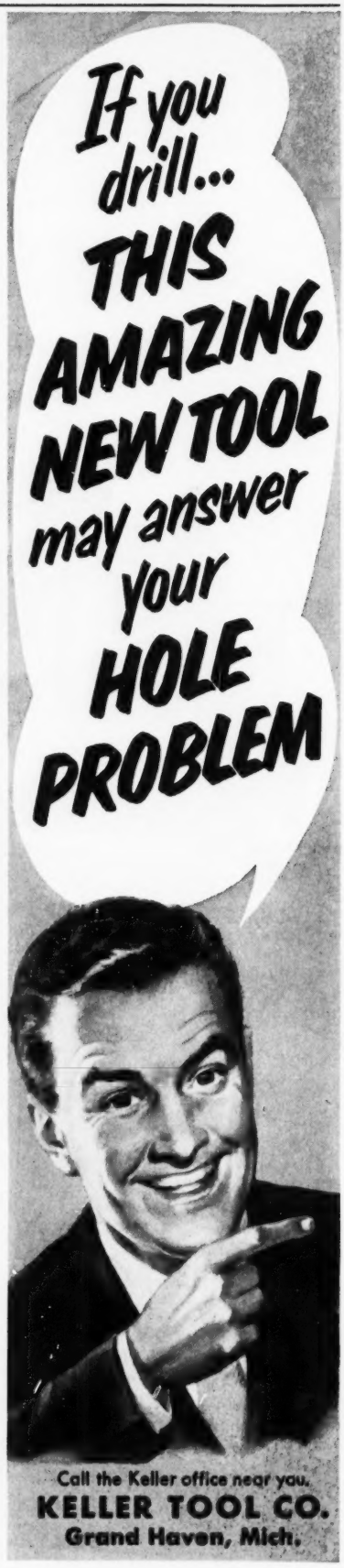
NIBBLING MACHINES
Campbell Machine Div., American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport, Conn.

NIBBLING MACHINES, Nickel
International Nickel Co., Inc., 67 Wall St., New York, N. Y.
Wales-Strippet Corp., N. Tonawanda, N. Y.

NIPPLE THREADING MACHINERY
Landis Machine Co., Inc., Waynesboro, Pa.

NUT MAKING MACHINERY
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

(*Continued on page 392*)


If you drill...
THIS AMAZING NEW TOOL may answer your HOLE PROBLEM
Call the Keller office near you.
KELLER TOOL CO.
Grand Haven, Mich.

For more information on products advertised, use Inquiry Card, page 247

Announcing

a completely AUTOMATIC, self-contained, PORTABLE drilling unit with advantages you expect only in expensive machine tools

Peck drilling four deep holes in a magnesium casting

THE NEW SERIES 92A KELLER "AIRFEEDRILL"

—locks to any jig or fixture, and drills accurately. Stationary mounting brackets available

—operates automatically through the complete drilling cycle—advances, drills, retracts, shuts off—at a single pressure of the control valve

—handles peck drilling and skip drilling

—gives complete control over motor speed, drilling speed, torque, rate of advance, and depth of hole

It has these operating features:

SENSING TYPE RAPID ADVANCE brings the drill point quickly to the work, then drops instantly to the drilling rate.

TORQUE CONTROL causes automatic retraction as often as necessary to clear chips during peck drilling. It also protects drills and indicates when they need sharpening.

FEED CONTROL permits adjustment to varying drilling conditions, as well as the material being drilled.

VARIABLE SPEED MOTOR controlled by throttle valve . . . shuts off automatically at end of drilling cycle.

Lightweight and compact—ideal for use in portable or stationary applications

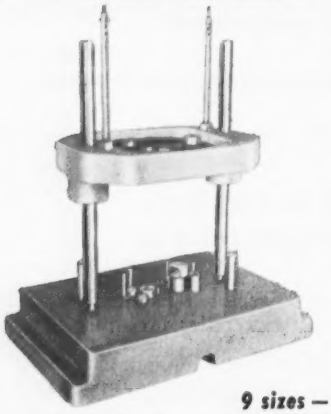
These and other features mean that you can tool up for a few hundred dollars . . . instead of thousands. Send for Catalog Section 92 which fully describes and illustrates this remarkable new tool.

KELLER "Airfeedrill"

SERIES 92A

KELLER TOOL COMPANY, 1307 Fulton St., Grand Haven, Mich.

Zagar Self-clamping
DRILL JIGS
NOW STANDARDIZED for DRILLING, REAMING, TAPPING



9 sizes — 5 combinations per size — for hole patterns 3" through 15" dia.

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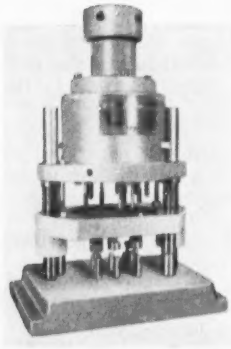

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Lufkin Rule Co., Hess Ave., Saginaw, Mich.
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Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

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Mueller Brass Co., Port Huron 35, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
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Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
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United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

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(*Continued on page* 394)

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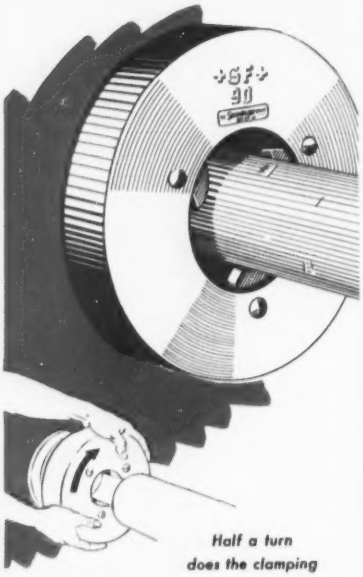

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Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
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Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
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Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
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(*Continued on page* 396)

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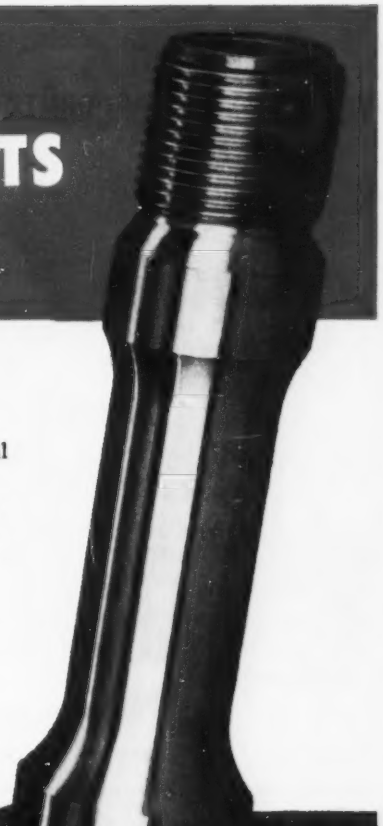

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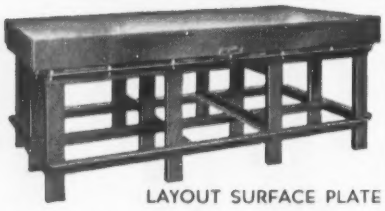

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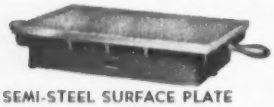

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Consolidated Mch. Tool Corp., Rochester, N. Y.
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Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
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Farquhar, A. B., Div., Oliver Corp., 142 North Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
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Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
L & J Press Corp., Elkhart, Ind.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
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Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
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Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Farquhar, A. B., Div., Oliver Corp., 142 North Duke St., York, Pa.
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Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Ill.

(Continued on page 398)

For more information on products advertised, use Inquiry Card, page 247

Black & Decker
Cases for Comment

MAINTENANCE

(Case History 8168)

Removing rust fast with wire brush and versatile B&D Portable Grinder

CONSTRUCTION

(Case History 10634)

1616 houses built at 2-a-day rate... thanks to B&D Heavy-Duty Saws

PRODUCTION

(Case History 10691)

20% more production 20% faster...it's a Black & Decker Drill

Photo shows drilling of 10 gauge steel for Victor Furnace. Manufacturer reports use of B&D Drill resulted in 20% speed up, 20% production increase. Drills standing up very well after 8–10 years use...8 hrs. a day...5½ days a week.

Jack-Sure shows long, trouble-free service

SMALL DRILLS. Typified by "handful of power" ¼" Heavy-Duty Holgun.* Ideal production tool. Exceptional in "close-corner" drilling.

LARGER DRILLS . . . Models and speeds to fit any job in capacities from ¼" to 1¼" in steel, double in hardwood.

SCREW DRIVERS . . . Drive anything from delicate screws to large nuts and bolts. Many models, positive and adjustable clutches.

SANDERS . . . Drive abrasive discs, wire cup brushes, saucer grinding wheels, other attachments. Four models, 7" and 9" capacities.

BENCH GRINDERS . . . Three models, 6"—10" wheel diams., ¼ to 1 H.P., for sharpening, grinding, wire brushing, buffing.

POLISHERS . . . Clean, polish, seal in *one* operation. Three models including unit with *exclusive* automatic polish feed.

HAMMERS . . . Drive star drills, bull points, etc., in masonry, other materials. Four models, ½" to 2" hole-capacity in concrete.

PORTO-SHEARS* . . . For fast, accurate cutting of ferrous and nonferrous sheet metal. Two models, 12 & 16 gauge capacities in steel.

VALVE SEAT GRINDERS . . . Famous "Vibro-Centric"* action puts a mirror finish on internal combustion engine valve seats in seconds.

PORTABLE GRINDERS . . . Bring the tool to heavy, bulky, hard-to-move work. Perfectly balanced. 3", 5" and 6" wheel diams.

VALVE REFACERS . . . Speedily grind factory-accurate angle on valve faces. Also grind valve stems, tappets and rocker arms for exact clearance.

FACTORY SERVICE . . . A B&D *extra!* Nationwide company-operated branches within 24 hours of *any* customer provide fast, accurate service at reasonable cost!

Industry reports prove . . . for increasing production . . . speedier construction . . . easier maintenance . . . *at lower cost* . . . it's hard to beat Black & Decker Power. They find that in every B&D Portable Electric Tool they get just the right power to do the job.

And they can be sure of getting this right power in B&D Drills, Screw Drivers, Saws, Grinders, etc., because Black & Decker custom builds its own motors. These motors, plus husky housings and precision parts, mean you get a tool that's easy to work with and hard to hurt. In every B&D Tool you have a real time-, trouble-, money-, and manpower-saver.

Want more information? Then ask around your industry . . . your own shop. Call your B&D Distributor for demonstration. And write for your copy of the complete *1954* B&D catalog. Address: THE BLACK & DECKER MFG. CO., 605 Pennsylvania Ave., Towson 4, Maryland.

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

PORTABLE ELECTRIC TOOLS

* Trade Mark Reg. U. S. Pat. Off.

PUMPS, Rotary

Brown & Sharpe Mfg. Co., Providence, R. I.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago, 19, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES

See Dies, Sheet Metal, Etc.

PUNCHES, Centering

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

PUNCHING MACHINERY

Allen, Alva F., Box 426 Clinton, Mo.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Tool Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Wales-Strippit Corp., N. Tonawanda, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

RACKS, Gear Cut

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Massachusetts Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

REAMER HOLDERS

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

REAMERS

Atrax Co., Newington, Conn.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

REAMERS, Adjustable

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMERS, Taper Pin

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kaufman Manufacturing Co., Manitowoc, Wis.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMING MACHINES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Greaves Machine Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

RECORDING INSTRUMENTS for Counting

National Acme Co., 170 E. 131st St., Cleveland, Ohio.

REELS, Stock, Standard and Automatic

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnace

Norton Co., 1 New Bond St., Worcester 6, Mass.

REGULATORS, Temperature

General Electric Co., Schenectady, N. Y.

REMOVERS, Japan, Enamel, Etc.

Oakite Products, Inc., 19 Rector St., New York, N. Y.

(*Continued on page 400*)

Everybody knows this sign

stands for dangerous curves

...and smart gear buyers

know this sign CINTI stands for

the best in custom gears.

CINTI "Gears...Good Gears Only"

THE CINCINNATI GEAR CO. • CINCINNATI 27, OHIO

For more information on products advertised, use Inquiry Card, page 247

Special Tools of Quality
Engineered to Save Your Time

DETROIT REAMER & TOOL CO.

2830 E. SEVEN MILE ROAD • DETROIT 34, MICH.

D R & T COMPANY

RETAINING RINGS FOR BEARINGS, Etc.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Wades-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

RHEOSTATS
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

RIVET SETS
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Thor Power Tool Co., Aurora, Ill.

RIVETERS, Hydraulic
Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hanna Engineering Works, 1752 Elston Ave., Chicago, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Morgan Engrg. Co., Alliance, Ohio.

RIVETERS, Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.

RIVETING MACHINES
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Tomkins-Johnson Co., Jackson, Mich.

RIVET MAKING MACHINES
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

RUBBER PRODUCTS
Garlock Packing Co., Palmyra, N. Y.

RULES, Steel
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

RUST PREVENTIVES
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAND BLAST EQUIPMENT
See Blast Cleaning Equipment

SANDERS
Black & Decker Mfg. Co., E. Penna Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll-Rand Co., Phillipsburgh, N. J.
Jarvis, Charles L., Co., Middletown, Conn.
Keller Tool Co., Grand Haven, Mich.
Kindt-Collins Co., 12653 Elmwood Ave., Cleveland 11, Ohio.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.

SAW BLADES, Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield Mass.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.
Victor Saw Works, Inc., Middletown, N. Y.

SAW SHARPENING MACHINES
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.

SAWING MACHINES, Friction
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.

SAWING MACHINES, Metal Cutting Band
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob Bros., Grafton, Wis.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.
Victor Saw Works, Inc., Middletown, N. Y.

SAWS, Circular Metal Cutting
Alina Corp., 401 Broadway, New York 13, N. Y. (Portable).
Brown & Sharpe Mfg. Co., Providence, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.

(*Continued on page* 402)

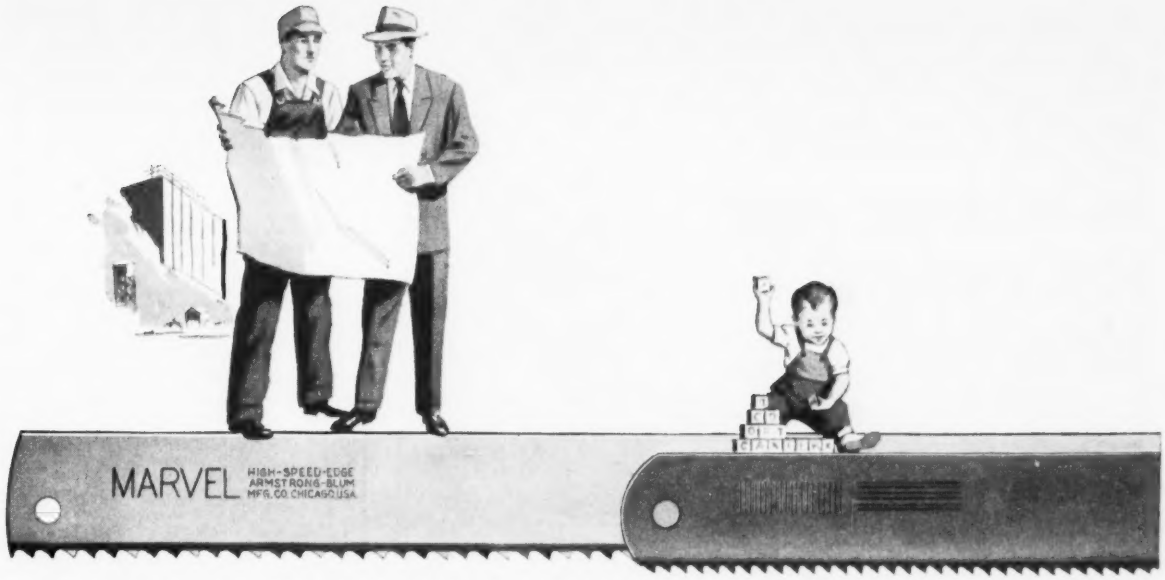
"- - - and then one day I made my fortune by switching the shop to Columbia SUPERDIE."

COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILL.

Producers of fine tool steels — All types immediately available through Sales Offices, Warehouses and Representatives in Principal Cities.

TOOL COLUMBIA STEELS

For more information on products advertised, use Inquiry Card, page 247



. . . *but*
Experience Cannot be Copied

More than a quarter-century ago MARVEL invented and basically patented the MARVEL High-Speed-Edge Hack Saw Blade—the UNBREAKABLE blade that increased hack sawing efficiency many-fold.

Every MARVEL Hack Saw Blade ever sold has been of that basic welded high-speed-edge construction, with constant improvements from year to year, as EXPERIENCE augmented the "know-how" . . .

MARVEL is not "tied" to any single source of steel supply, and has always used the best high speed steels that became available from time to time as metallurgy progressed. When-as-and-if finer steels are developed—and are proven commercially practical for welded-edge hack saw blades—MARVEL will use them, regardless of cost or source . . .

There is only one genuine MARVEL High-Speed-Edge! All other "composite" or "welded-edge" hack saw blades are merely flattering attempts to imitate — without the "know-how" of MARVEL EXPERIENCE . . .

Insist upon *genuine* MARVEL High-Speed-Edge when buying hack saw blades—and be SAFE, for you can depend upon MARVEL. They have been "tested", "pre-tested", and "re-tested" by thousands of users for more than a quarter-century!

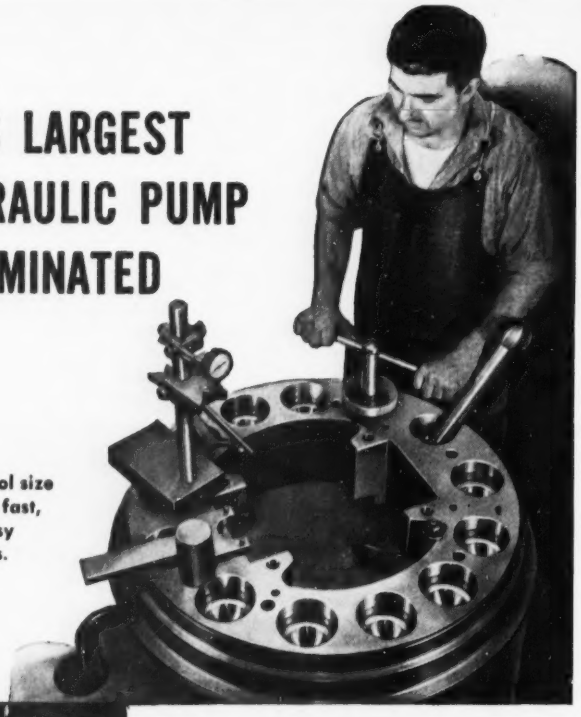
MARVEL *Metal Cutting* **SAWS**

Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO. · 5700 Bloomingdale Ave. · Chicago 39, U. S. A.

For more information on products advertised, use Inquiry Card, page 247

WORLD'S LARGEST OIL HYDRAULIC PUMP USES LAMINATED SHIMS



New Waterbury Tool size "300" pumps gain fast, accurate fit and easy service adjustments.

Heart of this huge 20-ton hydraulic pump is the immense revolving assembly of angle plate, connecting rods and pistons. Tilting the angle plate permits rapid reversing under heavy load. Both ends of the connecting rod bearings – at angle plate and pistons – are assembled and adjusted with Laminated Shims. Shown in large picture is angle plate being assembled. Smaller picture gives size of complete revolving assembly. Pumps will be used in Tube Reducing Machine being built by E. W. Bliss Co. for the Tube Reducing Corp.

The largest oil hydraulic high pressure pumps ever built presented a host of new engineering problems—but the old, familiar problems of fast accurate assembly and easy service adjustments were solved by the old familiar remedy . . . *laminated shims!*

For laminated shims in steel, stainless steel, brass, aluminum and combinations of metals call us first! Forty years of shim engineering experience are at your service! Please write for further information and our new catalogue, yours without cost or obligation.

Simply P-E-E-L for adjustment.

SHIM HEADQUARTERS SINCE 1913

Check Our Stampings Division For Your Stamped Parts Requirements

LAMINATED SHIM COMPANY, INC.

3905 UNION STREET • GLENBROOK • CONNECTICUT

Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Union Twist Drill Co., Athol, Mass.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co. 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Portable Electric

Back & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Millers Falls Co., Greenfield, Ohio.

SAWS, Screw Slotting

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCRAPERS, Hand and Power

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

SCREW DRIVERS, Power

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

SCREW DRIVING AND NUT SETTING EQUIPMENT

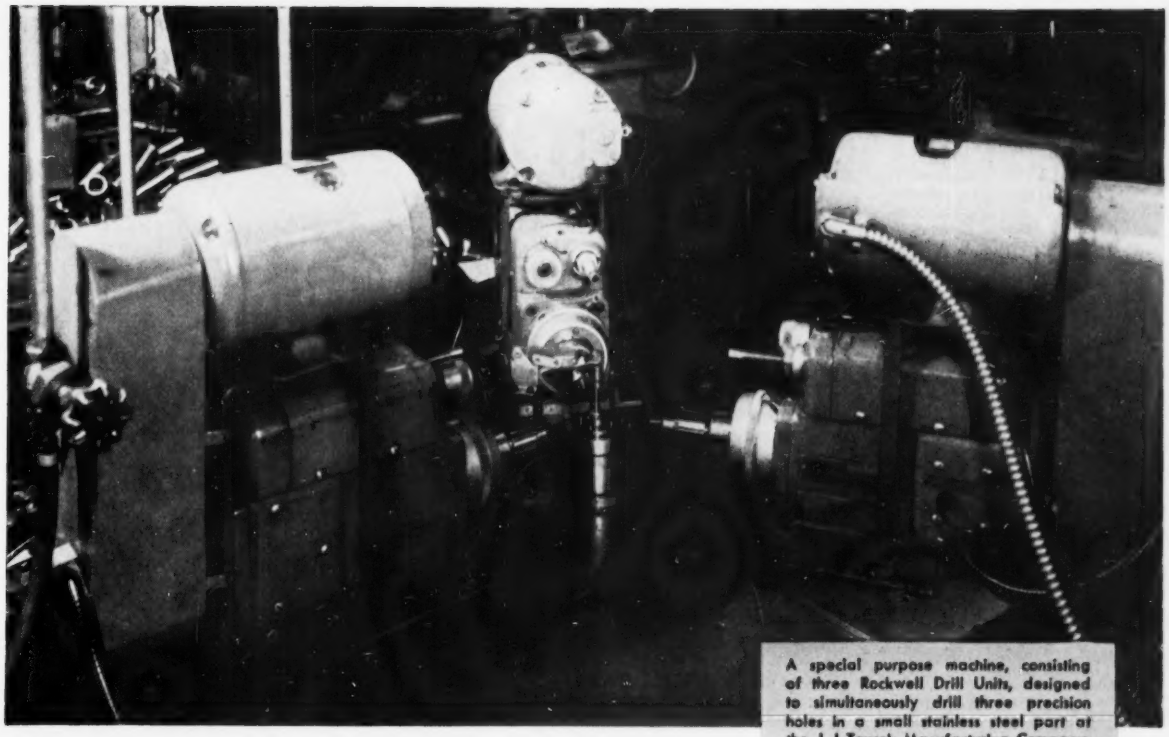
Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Jarvis, Charles L., Co., Middletown, Conn.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

SCREW MACHINE TOOLS AND EQUIPMENT

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

(*Continued on page* 404)

For more information on products advertised, use Inquiry Card, page 247



A special purpose machine, consisting of three Rockwell Drill Units, designed to simultaneously drill three precision holes in a small stainless steel part at the J. J. Tourek Manufacturing Company. The operation cuts parts cost 43%. Precision Rockwell Drill Units reduce time and motion in countless machining and assembly operations—can be mounted in any tooling arrangement.

J. J. Tourek Manufacturing Company
CUT PER PART COSTS 43%

with Rockwell* Air-Hydraulic Drill Units!

When production requirements at J. J. Tourek Manufacturing Co., Chicago, demanded a machine to drill small parts much faster than the single drill method, design engineer Donald Moeller developed a simple machine around Rockwell Air-Hydraulic Drill Units. It achieved the needed production and cut per part cost by 43% on the complete size range of stainless steel parts.

Says Mr. Moeller, "In the one year we've had our Rockwell Drill Units in two-shift production, their fast, reliable performance has exceeded our expectations. They've sped up production terrifically, reduced our costs and greatly increased drill life. Maintenance costs are so low we don't bother to record them."

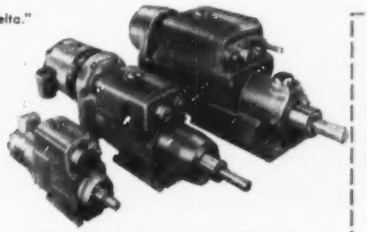
The Rockwell Drill Unit is a hydraulically controlled, precision packaged power unit that provides positive automatic control of length of rapid approach, feed, and depth. Singly or in multiples, it can be electrically interlocked with other units or mechanisms, and can be operated by unskilled personnel with a minimum of training. The Rockwell Drill Unit has proven time and time again that it can save big money in drilling, tapping, counter-boring, and kindred operations. *It can do it for you.*

Let your Authorized Sales Engineer discuss possibilities with you. He not only offers you engineering counsel, but can also demonstrate right in your plant. Send the coupon today for his name.

*Originally produced by Rockwell under the trade name "Delta."

Air-Hydraulic **DRILL UNITS**

Another Product by **Rockwell**



15 Drive Arrangements—from ⅓ to 5 hp.

Drill Unit Division, Rockwell Manufacturing Company
614E North Lexington Avenue, Pittsburgh, Penna.

☐ Please send name of nearest Authorized Sales Engineer.

☐ Please send me latest Drill Unit Catalog.

Name _____ Title _____

Company _____

Address _____

City _____ County _____ State _____

SCREW MACHINE WORK

Eastern Mch. Screw Corp., New Haven, Conn.
Mueller Brass Co., Port Huron 35, Mich.
National Acme Co., 170 E. 131st St., Cleveland.
Ottemiller, W. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Wicaco Machine Corp., Stenton Ave., and Louden St., Philadelphia, Pa.

SCREW MACHINES, Automatic Single and Multiple Spindle

Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINES, Hand

See also Lathes, Turret

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Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
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Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES

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Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Winter Bros. Co., Rochester, Mich.

SCREWS, Cap, Set, Safety Set and Machine, Etc.

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Chicago Screw Co., Bellwood, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS, Self-tapping, Drive

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

SCREWS, Thumb

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SEALS AND RETAINERS, Oil or Grease

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Garlock Packing Co., Palmyra, N. Y.
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

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Miles Machinery Co., Box 770 Saginaw, Mich.
Morey Machinery Co., Inc., 383 Lafayette St., New York, N. Y.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

SEPARATORS, Centrifugal

De Laval Separator Co., Poughkeepsie, N. Y.
The Sharples Corp., 2300 Westmoreland St., Philadelphia 40, Pa.

SEPARATORS, Oil or Coolant

Barnes Drill Co. (Magnetic), 814 Chestnut, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
The Sharples Corp., 2300 Westmoreland St., Philadelphia 40, Pa.

SHAFTING, Steel

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
De Laval Separator Co., Poughkeepsie, N. Y.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg. Cleveland 1 Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P.O. Box 1557 Pittsburgh, 30, Pa.

SHAFTS

National Forge & Ordnance Co., Irvine, Warren County, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Summerill Tubing Co., Div., Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAFTS, Flexible

Jarvis, Chas. L., Co., Middletown, Conn.

SHAFTS, Hollow-Bored

Bethlehem Steel Co., Bethlehem, Pa.

SHAFTS, Turned and Ground

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P.O. Box 1557, Pittsburgh 30, Pa.

SHAPER-PLANERS

Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

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Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
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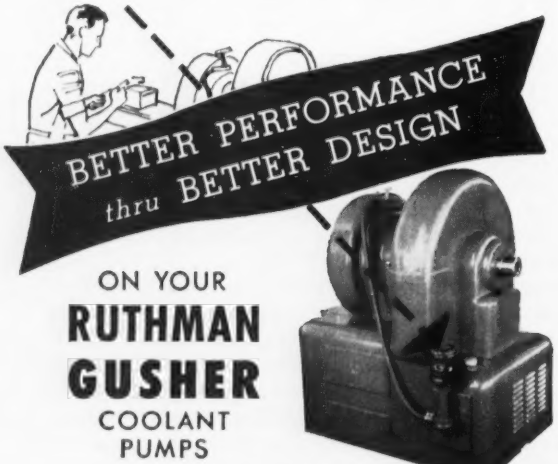
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

(*Continued on page* 408)



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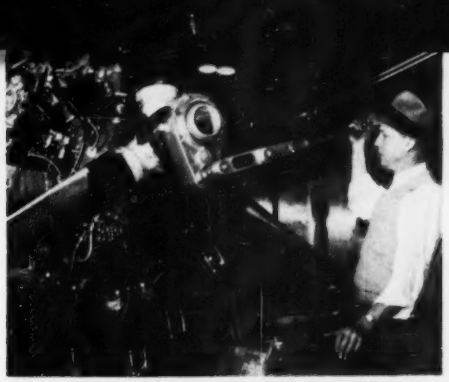

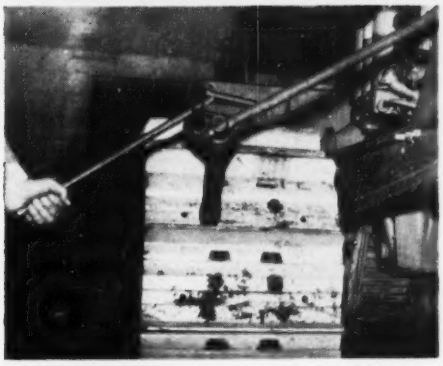

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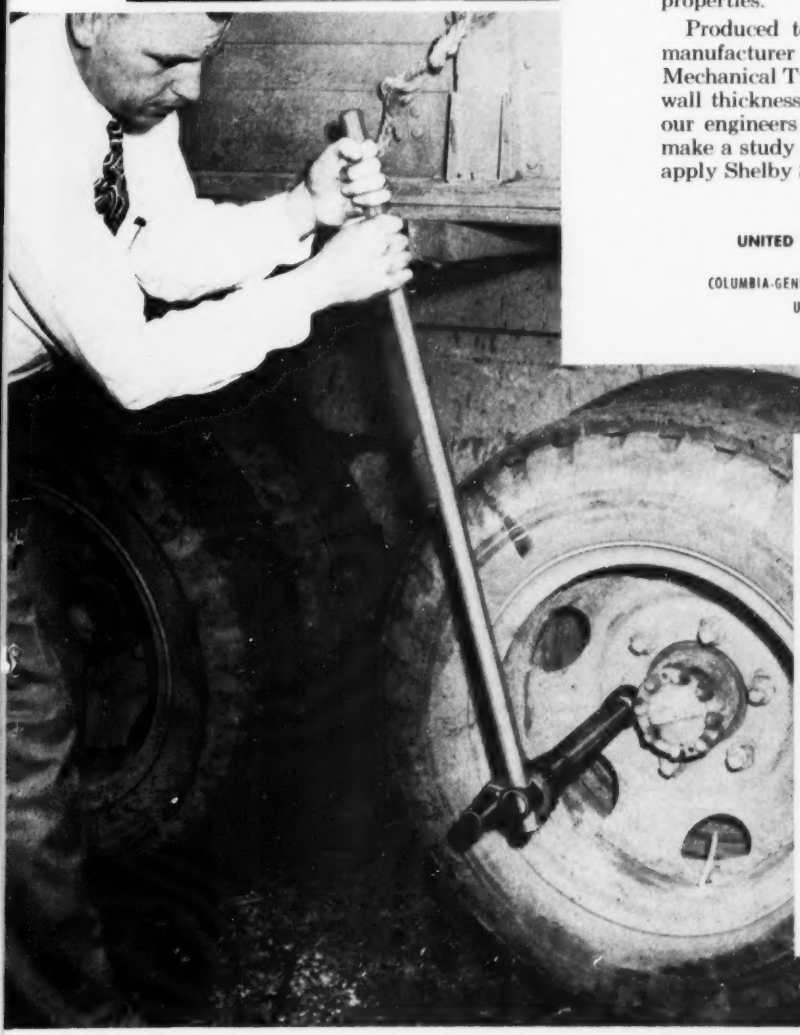

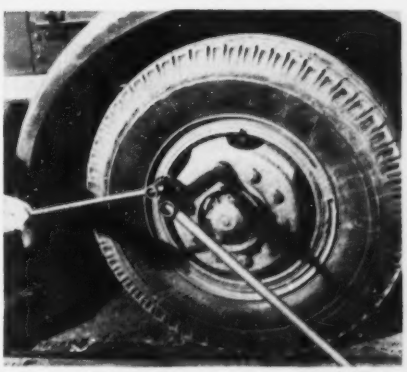

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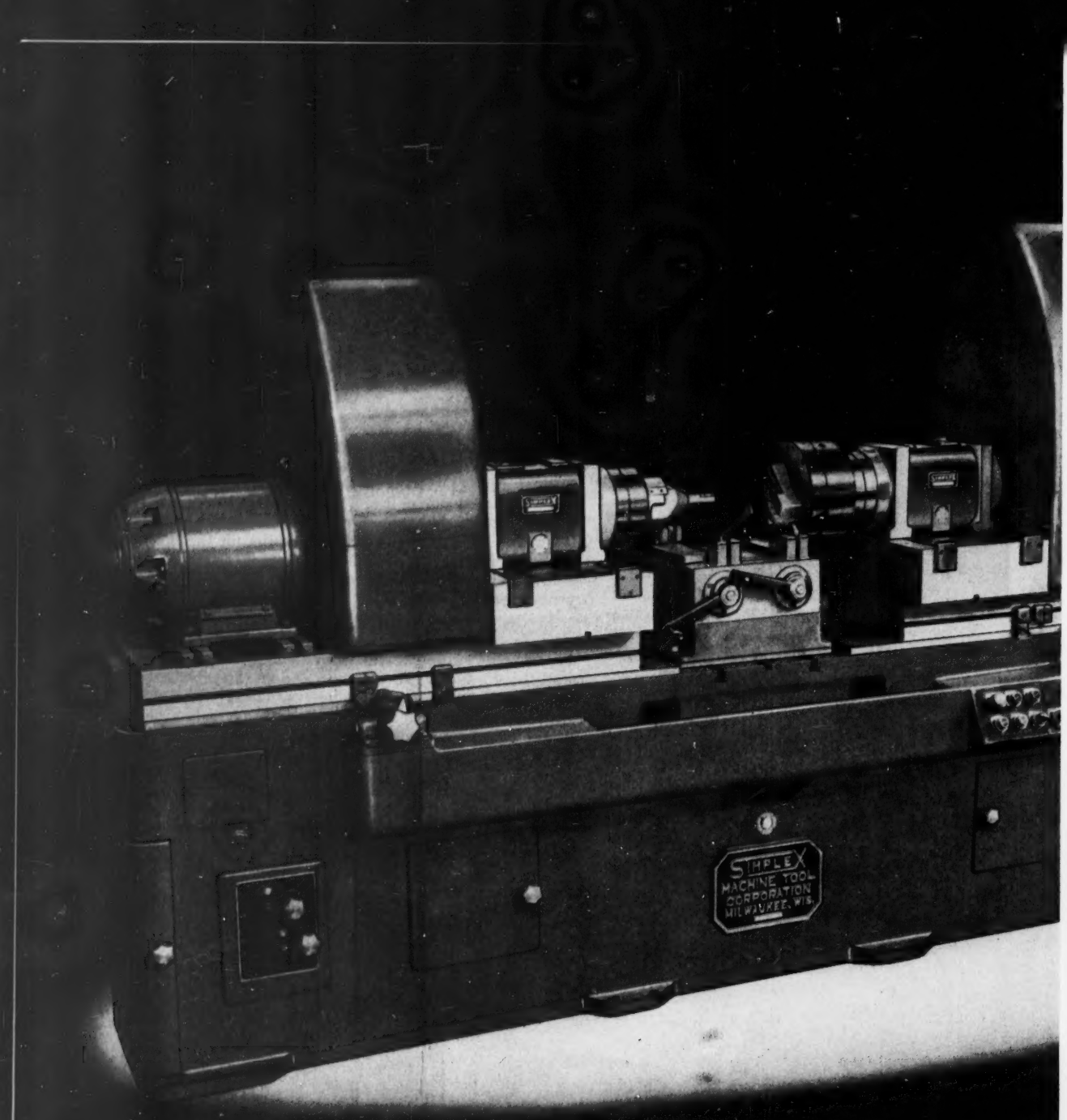

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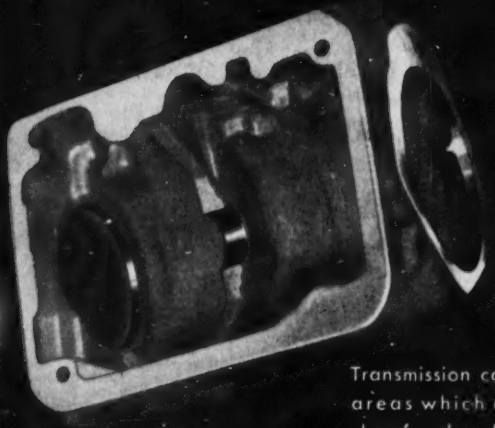
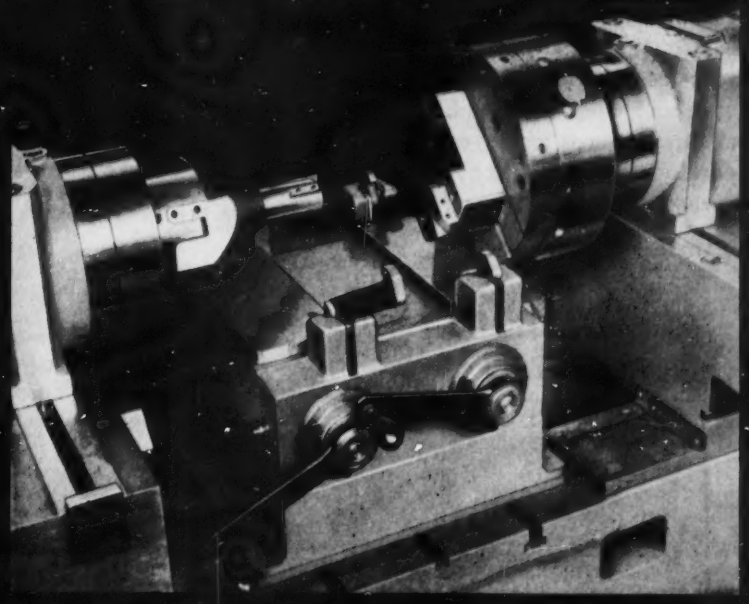


Transmission case showing areas which are bored, chamfered and faced.



Close up of the manually clamped type work holding fixture and tooling with a hydraulically actuated cross facing head.

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Columbia Steel & Shafting Co., P.O. Box 1557, Pittsburgh 30, Pa.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P.O. Box 1557, Pittsburgh 30, Pa.

SHAPES, Structural

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U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

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Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilburn Ave., Chicago, Ill.
Morgan Engrg. Co., Alliance, Ohio.
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Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

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Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

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Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
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Union Twist Drill Co., Athol, Mass.

SHEARS, Squaring

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Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
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Consolidated Mch. Tool Corp., Rochester, N. Y.
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New Jersey Zinc Co., 160 Front St., New York, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave. Pittsburgh, Pa.

SHEETS, Iron and Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
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Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
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Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Baker Bros., Inc., Sta. F., P.O. Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
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Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
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Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
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(*Continued on page* 412)

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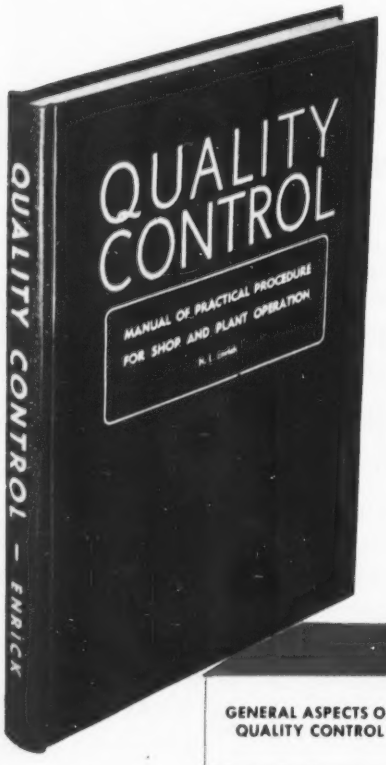

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Fundamentals of modern Quality Control	Charts for Quality Control during production	Ready-made sampling plans for various lot sizes and allowable defectives	Quality research with analysis of variance
Organization and management	Charts for incoming materials (acceptance control)	Single and sequential sampling	Special problems in piece-parts production
Inspection, gaging and testing	Special charts for highly variable equipment	Sampling plans for major and minor defects	Special techniques in continuous product sampling
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Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Michigan Tool Co., 7171 E. McNicholas Rd., Detroit 12, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Motch Match & Merryweather Mchry. Co., Penton Bldg., Cleveland, Oho.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc. S 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicoco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

SPEED REDUCERS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass.
Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears, Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Perkins Machine & Gear Co., West Springfield, Mass.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

SPINDLES, Grinding

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Pope Mchry. Corp., Haverhill, Mass.
Taft-Peirce Mfg. Co. Woonsocket, R. I.

SPINNING LATHES

See Chucking Machines.

SPROCKET CHAINS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

SPROCKETS

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

STAMPINGS, All Metal

LaSalle Steel Co., Hammond, Ind.
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl. Chicago 12, Ill.

STAMPINGS, Sheet Metal

Laminated Shim Co., Inc., Glenbrook, Conn.
Republic Steel Corp., Niles Steel Products Div., Republic Bldg., Cleveland 1, Ohio.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl., Chicago 12, Ill.

STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co., of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Summerill Tubing Co., Div., Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

(*Continued on page* 413)

SHELDON
CHICAGO U.S.A.
PRECISION LATHES

SHELDON
"Stamina" Features:

- Rigid, Heavily cross-strutted 1-piece Beds—2 V-ways, 2 Flat ways
- Full Double-Walled Aprons—all gear shafts supported on both ends.
- Heavy Carriage with wide bearing on bed.
- Twin V-Belts to Spindle for extra power.

Precision that lasts
. . . "ZERO PRECISION" TAPER ROLLER BEARINGS

No lathe can be more accurate than its spindle bearings. Hence before buying any lathe one should check the *exact* type and tolerances of bearings used.

The No. TS-56B (and several other) SHELDON Precision Lathes have "Zero Precision" Taper Roller Bearings, held to tolerances of .00015". Not only are these the most accurate bearings used in any lathe, they are the sturdiest type . . . hold their accuracy thru long hard use . . . hold it even under abuse. With the other stamina features built into SHELDON Precision Lathes, they assure continued accuracy, without costly maintenance, thru years of hard service.

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SHELDON MACHINE CO., INC.
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For more information on products advertised, use Inquiry Card, page 247

Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div. Tennessee Coal, Iron & R. R. Co. Div.), 436 Ave., Pittsburgh, Pa.
U. S. Steel Supply Div., U. S. Steel Co., 208 S. LaSalle St., Chicago 4, Ill.
Wheeler-Lovejoy & Co. Inc., Cambridge, Mass.

STEEL, Cold Drawn

Allegheny Ludlum Stell Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Crucibe Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St.. Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., Massillon, Ohio.
Ryerson ,Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co. Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co. Div.) 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, High Speed Tool

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co., of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Machine

Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

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Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div. Carnegie-Illinois Steel Corp. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

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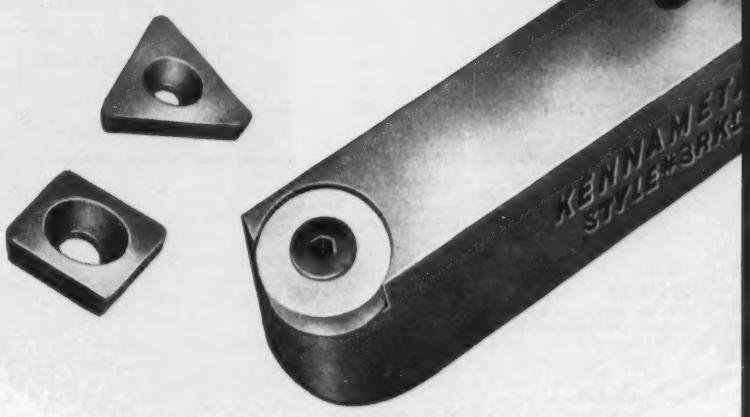
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

STEEL, Tool and Die

Allegheny Ludlum Steel Corp., Pittsburgh, Pa
Carpenters Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

(Continued on page 414)

It Pays to Know Your KENDEX* Tooling



There are no substitutes for Kendex inserts. Only Kennametal Inc. makes them—and they're made only of Kennametal.

Kendex inserts are round, square, or triangular tool blanks having multiple, precision-ground cutting edges; designed for screw-mounting to enable fast, accurate indexing without resetting the tool. When all cutting edges of a Kendex insert have been used, the insert is thrown away—*no resharpening.*

You can obtain these advantages with Kendex tooling: (1) Minimize downtime for tool changing; (2) Eliminate tool grinding expense; (3) Prevent temptation to "save" money by reconditioning tools that have outlived their usefulness. Ask your nearest Kennametal representative for details. Kennametal Inc., Latrobe, Pa.

HOW KENDEX* WORKS

1 Hard, strong, wear-resistant Kennametal is molded into square, round, or triangular Kendex inserts, which are precision ground.

2 Kendex inserts are mounted to suitable tool holders with socket head screws.

3 When edge becomes dull, insert is turned to new cutting position. When all cutting edges have been used, insert is thrown away; no regrinding.

*Registered Trade-Marks

KENNAMETAL*

CEMENTED CARBIDE TOOLING THAT INCREASES PRODUCTIVITY

SALES OFFICES IN PRINCIPAL CITIES

A-4

Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STEEL ALLOYS
See Alloys, Steel

STEEL BARS
See Bars, Steel

STEEL STOCK GROUND FLAT
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

STELLITE
Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. of Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.

STONES, Oil or Sharpening
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.

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Standard Pressed Steel Co., Jenkintown, Pa.

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Taft-Peirce Mfg. Co., Woonsocket, R. I.

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American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
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Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

STRIPPING UNITS, Die
Wales-Strippit Corp., N. Tonawanda, N. Y.

STUD SETTERS
Errington Mechanical Laboratory Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.

SUB-PRESSES
Waltham Machine Works, Newton St., Waltham, Mass.

SUPERFINISHING MACHINES
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES
See Plates, Surface

SWAGING MACHINES
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Torrington Co., Torrington, Conn.

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Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
Control Products, Inc., (Waterproof and Thermal), 306 Sussex St., Harrison, N. J.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

TACHOMETERS
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

TAPER PINS, Standard
Alimetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only).
Chicago Screw Co., Bellwood, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.
Pratt & Whitney, West Hartford 1, Conn.

TAP HOLDERS
Burg Tool Mfg. Co., 3743 Durango Ave., Los Angeles 34, Cal.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

TAPPING ATTACHMENTS AND DEVICES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Challenge Mchry. Co., Grand Haven, Mich.
Cleveland Tapping Machine Co., Canton 6, Ohio.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

TAPPING MACHINES, Nut
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

TAPS
Besly-Welles Corp., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Continental Tool Works, Div. Ex-Cell-O. Corp., Detroit 32, Mich.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Iroquois Corp., RFD 4 Box 331, 1800 E. 11 Mile Rd., Royal Oak, Mich.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Winter Bros. Co., Rochester, Mich.
Wood & Spencer Co., 1930 E. 61st St., Cleveland, Ohio.

TAPS, Collapsing
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

THREAD CUTTING MACHINERY
Brown & Sharpe Mfg. Co., Providence, R. I
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.

(Continued on page 415)

Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

THREAD GAGES

See Gages, Thread.

THREAD GRINDING MACHINES

See Grinding Machines, Thread

THREAD MILLING MACHINES

Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Waltham Machine Works, Newton St., Waltham, Mass.

THREAD ROLLING HEADS

National Acme Co., 170 E. 131st St., Cleveland, Ohio.

THREAD ROLLING MACHINES

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

TIN AND TERNEPLATES

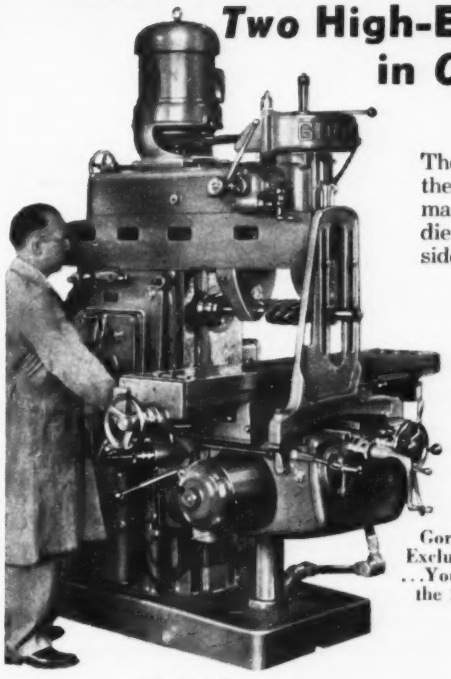
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co. Div., Tennessee Coal Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

TOOL BITS, High Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besley-Welles Corp., Beloit, Wis.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(*Continued on page* 416)

New Gorton 2-28 Brings You *Two* High-Efficiency Mills in *One* Money-Saving Unit



. . . as a horizontal mill.

The Gorton Receptor Ram makes the new 2-28 a true multi-purpose machine . . . "tailor-made" for *all* die-mold-machine shops. Consider the facts:

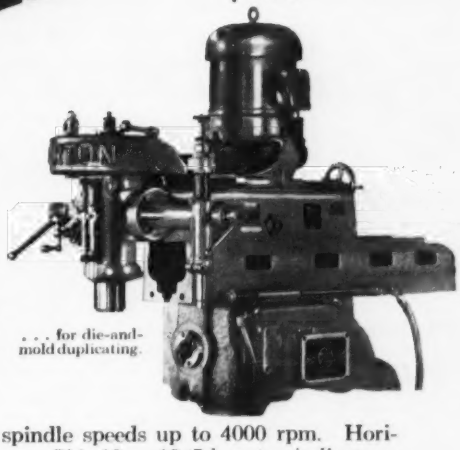
Gorton Exclusives . . . Yours in the 2-28

HORIZONTAL MILL

VERTICAL MILL (Super-speed)

DUPLICATOR (Simply add a duplicator head and a duplicator table.)

NOTE: You can switch from horizontal to vertical high-speed milling in 5 minutes or less. Save space and capital equipment — and increase production facilities at the same time.



. . . for die-and-mold duplicating.

- Fullwidth knee, 24½ inches wide, provides extreme rigidity. Even under heavy cutting loads, there's no sag or twist.
- New lubrication system dissipates heat to prevent spindle "growth" . . . to promote full use of spindle horsepower . . . to end the necessity for adjusting cutter depth to compensate for differences between "hot" and "cold" operation.
- High-speed head delivers spindle speeds up to 4000 rpm. Horizontal spindle: up to 2000 rpm — 7½, 10 or 10/5 hp *at spindle nose.*
- Double-extension feature of the Receptor Ram greatly increases work area, vertical capacity and transverse cutting capacity on either the Gorton 2-28 or 3-34 Horizontals.
- Down time and maintenance are drastically reduced by *true* unit construction features. A removable coolant pan speeds sump cleaning and coolant changing.
- Overload protection automatically safeguards expensive cutters. A horsepower-load meter constantly indicates cutter condition and operating efficiency.
- Full directional front and rear controls are interlocked.

You can't afford to overlook this Gorton Horizontal with Receptor Ram. It could produce more profit per dollar invested than any other machine you have. Fill out and mail the coupon.

GEORGE GORTON MACHINE CO.

1305 Racine St., Racine, Wis., U.S.A.

Please send at once Bulletin 1655-1305 and data on Gorton Horizontals.

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Title .....
Address .....
City, State .....

TOOL BITS, Special Alloy
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
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DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL GRINDERS
See Grinding Machines for Sharpening, Turning and Planning Tools.

TOOL GRINDING ATTACHMENTS
Detroit Reamer & Tool Co., 2830 E. 7 Mile Rd., Detroit, Mich.

TOOL HOLDERS
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Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

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Atrax Co., Newington, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
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(*Continued on page* 418)

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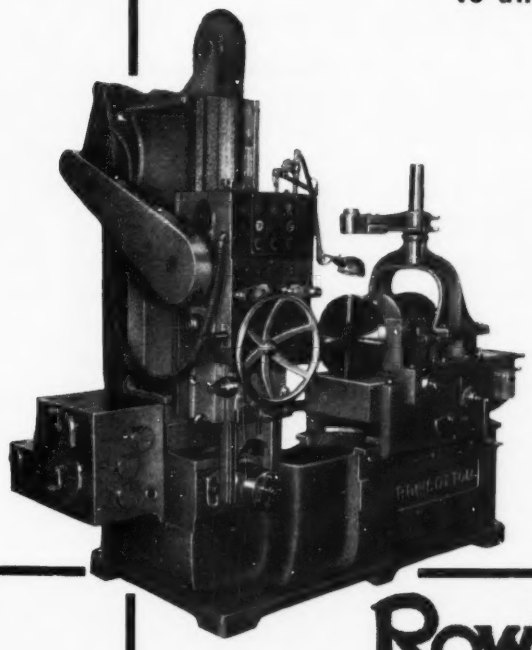

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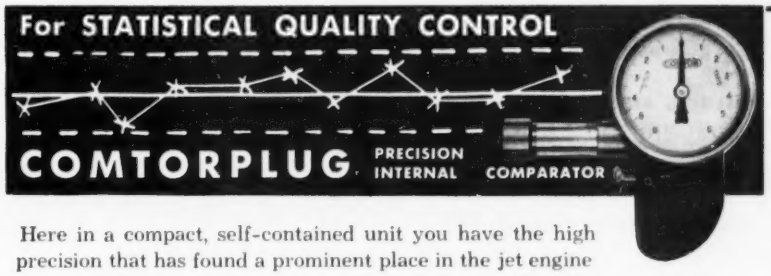

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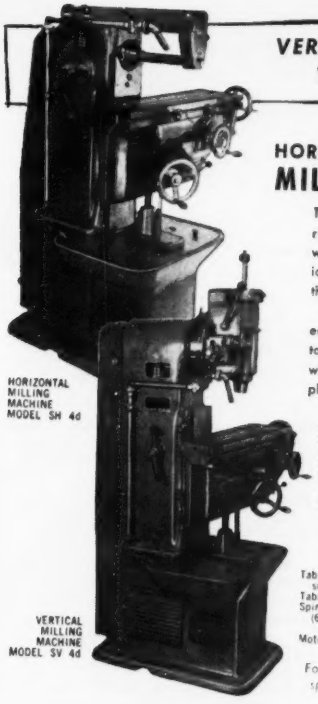

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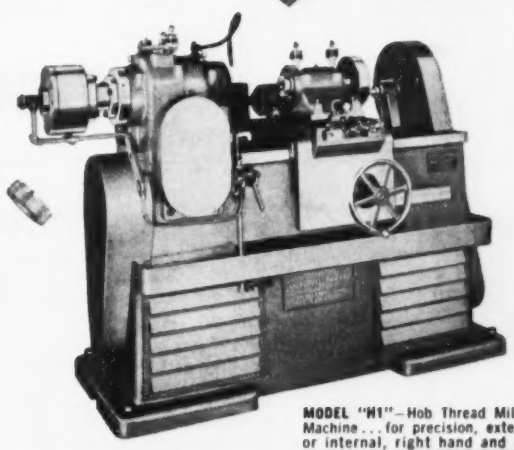

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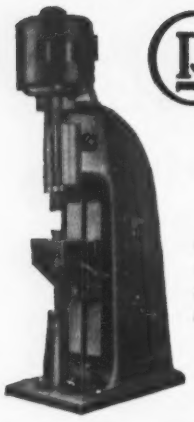

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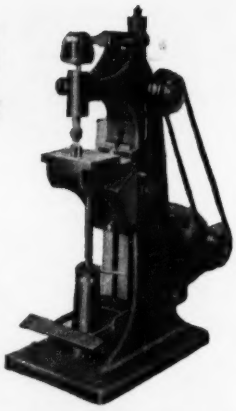

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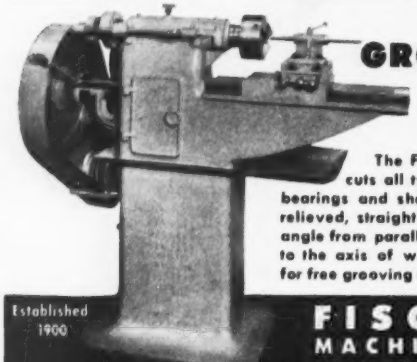

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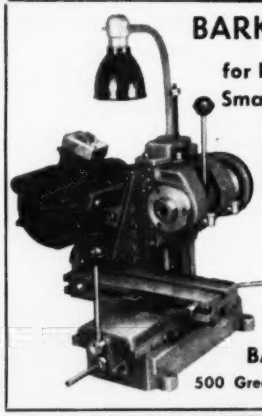

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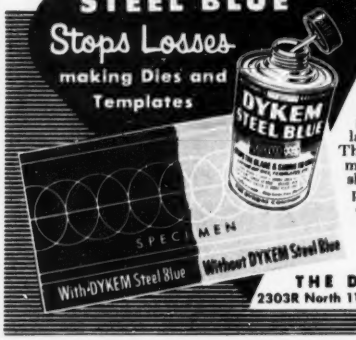

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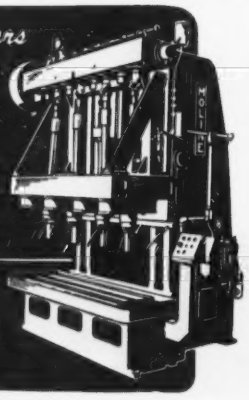

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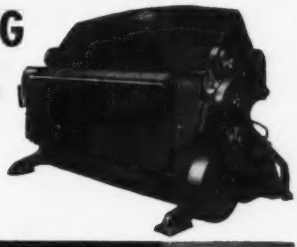

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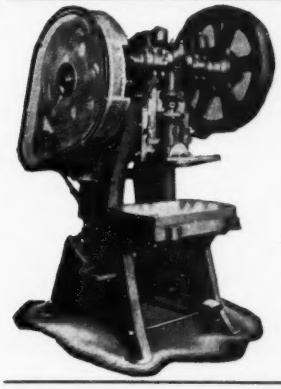

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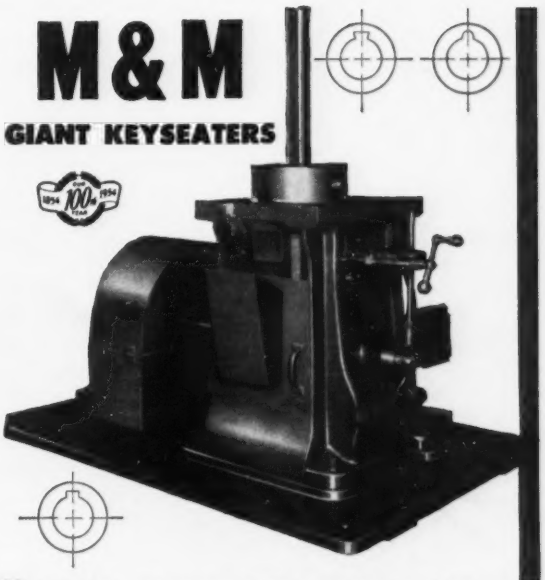

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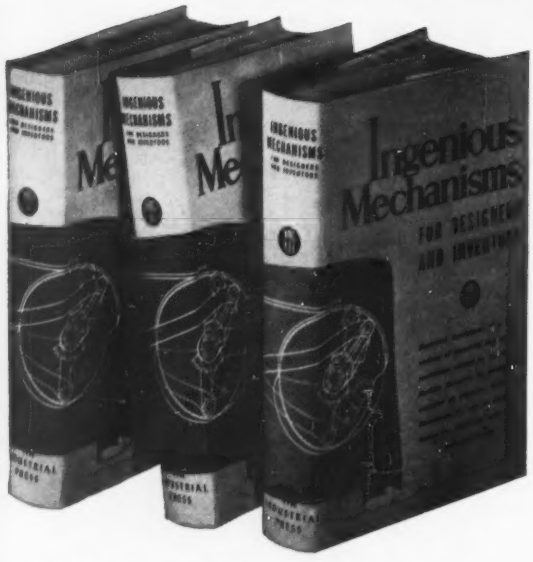

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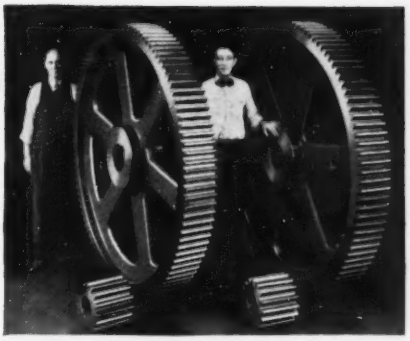

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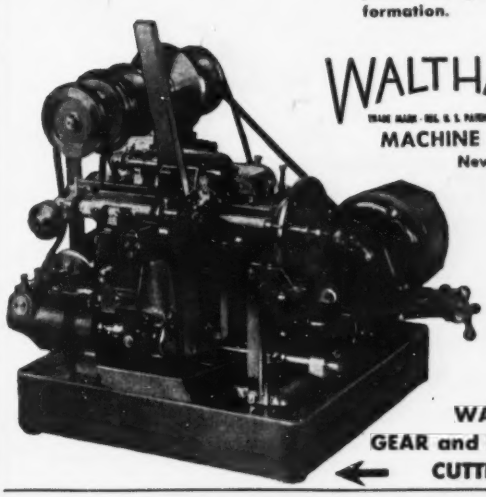

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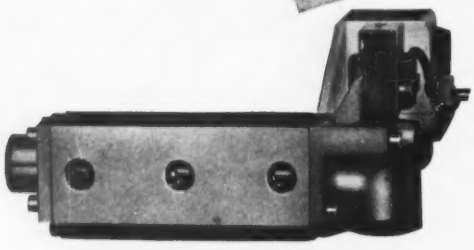

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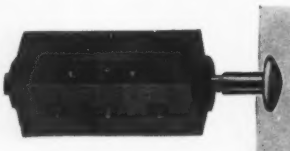

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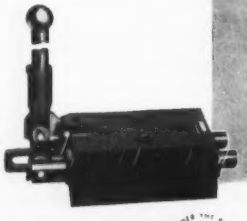

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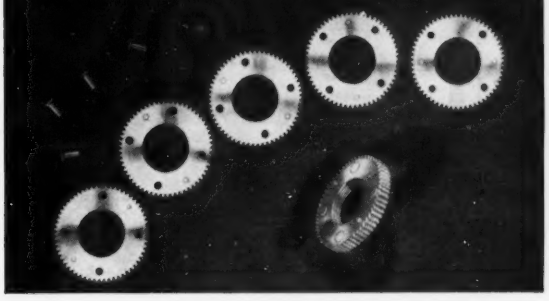

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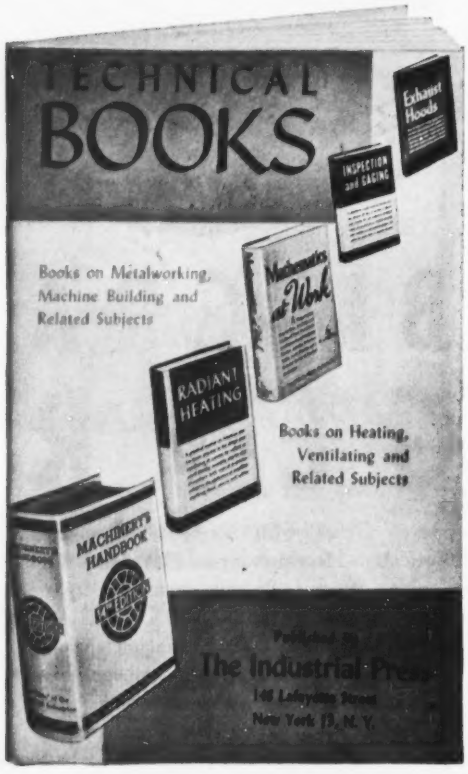

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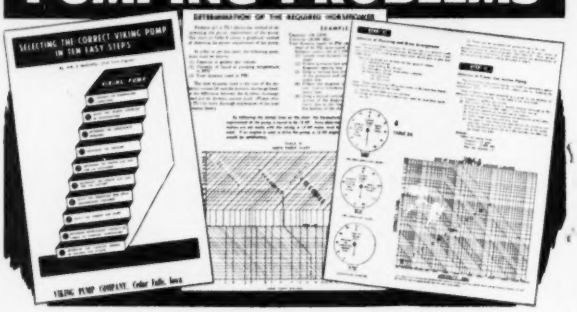

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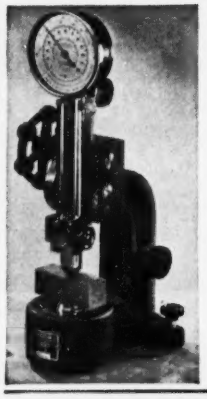

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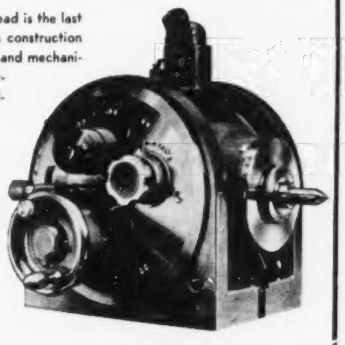

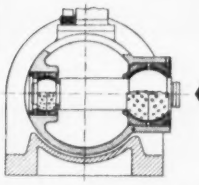

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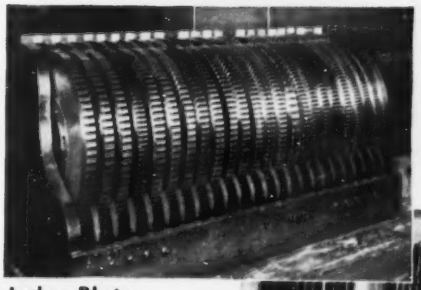

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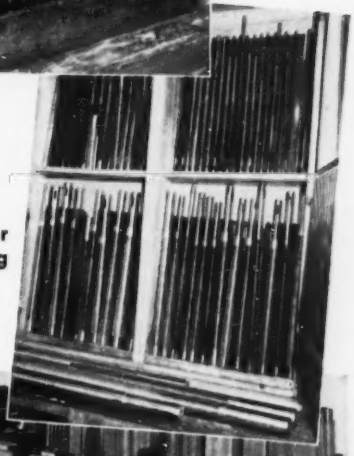

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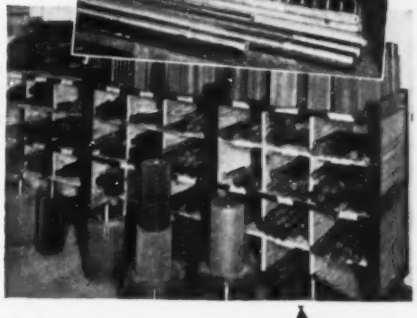

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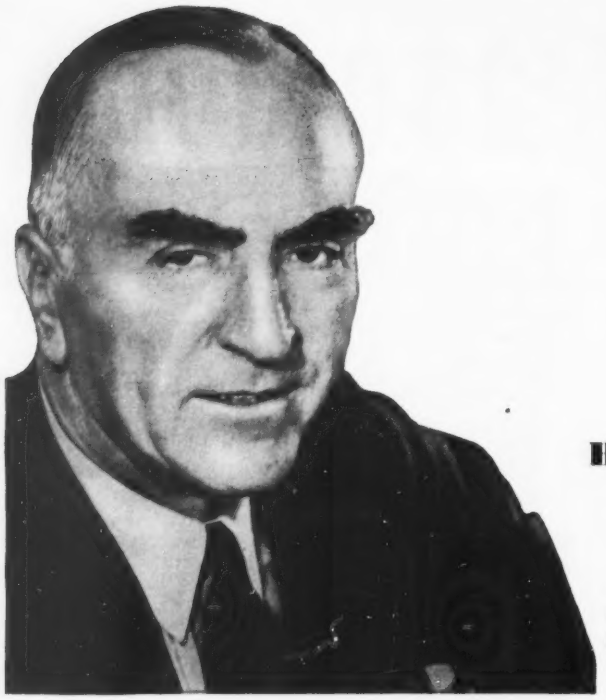

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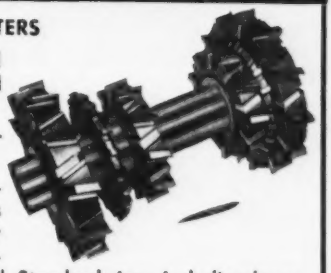

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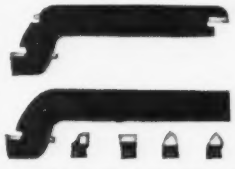

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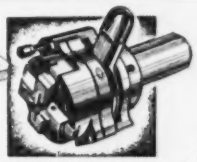

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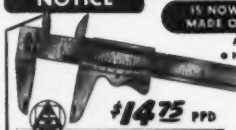

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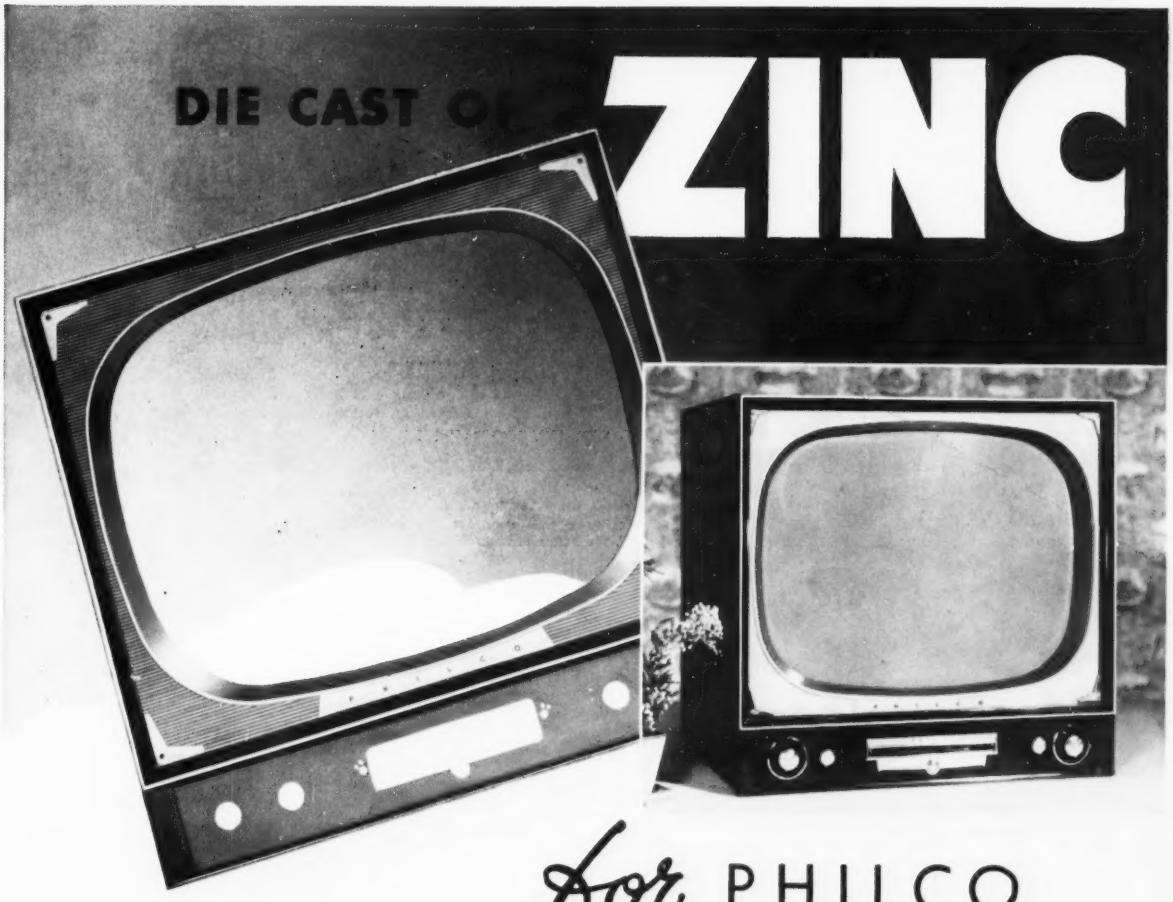

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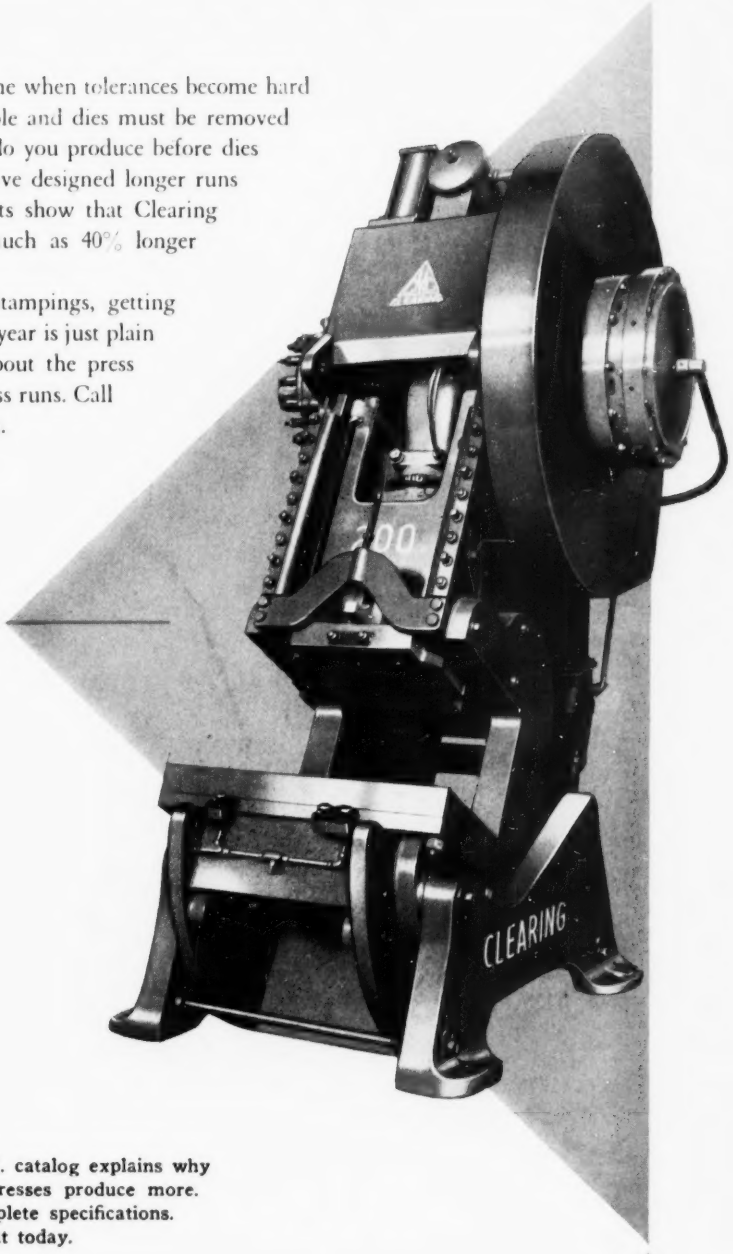

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